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The Development of Government Cloud Computing: An Institutional Perspective

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Declaration of Authorship

I, Khalid Alzadjali, hereby declare that this thesis and the work presented in it is entirely my own. Where I have consulted the work of others, this is always clearly stated.

Signed: _____
Date: _____

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Abstract

Cloud computing is a new infrastructure technology that is changing our understanding of systems implementation and infrastructure complexity and providing standard uniform services for an organisation. Cloud computing implementation seems to be in contention with the accumulated knowledge of Information systems (IS) implementation and IS infrastructure implementation which highlights the difficulties and barriers to standardisations.

This research examines the implementation of the National Government Cloud Infrastructure as a Service (IaaS) programme in Oman. It adopts an institutionalist perspective by considering the important role that institutional context and forces play in systems adoption and implementation (Avgerou 2000; Currie and Guah 2007). In particular, it adopts the lens of institutional forces and aims to answer the research questions: How do institutional forces affect the implementation of government cloud computing? and what organisational practices can lead to the adoption and implementation of cloud computing in government? To answer these questions, it follows a qualitative interpretive approach. Its data collection method consisted of in-depth; face-to-face, semi-structured interviews; document reviews; emails; participant observations of online communities and groups; informal discussions; and review news items.

This study explored the role played by coercive and mimetic forces in information infrastructure's standardisation. While normative forces hindered implementation standards, their effects were less significant than either of these forces. The overall findings show that institutional forces play an important role in standardising the way information infrastructure is implemented. More specifically, the findings unfold the different institutional forces that play a significant role in the implementation of government cloud computing. This is in contrast with recent findings that normative forces have resulted in the failure of system implementation in large IS infrastructure (Currie 2012). This study contributes to theory by (a) providing insight into the adoption and implementation of cloud computing in government which is lacking from the literature, (b) providing an interpretive understanding of cloud computing adoption and implementation as large information infrastructure in organisations, and (c) providing in-depth understanding of the relationship between the different institutional forces that

could impact the adoption and implementation of cloud computing. In doing this, the study contributes to practice by recommending institutional interventions to stimulate large-scale cloud computing adoption and implementation. Additionally, the study provides valuable insights to practitioners who seek to understand how institutional forces help in implementing large information infrastructure such as the Government Cloud.

Table of Contents

List of Figures

List of Tables

1. Chapter One: Introduction

1.1. Introduction

The objective of this introductory chapter is to present to the reader an overview of the research. This chapter is divided into seven sections. Section 1.2 provides an overall background to the research undertaken. Section 1.3 presents the research problem and highlights the research gaps. Section 1.4 states the purposes and objectives of the research. The research design is introduced in section 1.5 while Section 1.6 explains the importance of the research, and Section 1.7 provides an overview of the thesis structure. The final section, section 1.8, sums up this chapter.

1.2. Research Background

In today's globally competitive environment, along with increasing public demand for quality services, national governments are under pressure to improve their service levels. National governments continue to be under pressure to seek out ways to manage, control and deliver solutions more effectively and efficiently (Belanger et al. 2012; Lim et al. 2012). In response to these pressures, the adoption and deployment of IS in government have become an essential tool for providing instant and responsive services. However, delivering IS solutions is challenging, as it requires seamless communication, integration, coordination, and standardisation of information and services between different government agencies (Ciborra et al. 2000; Fountain 2001). Building and implementing information technology (IT) infrastructure in general and at national level involves many socio-technical complexities (Brown et al. 2011; Henningsson et al. 2011) and requires standard implementation across all government agencies. The study of IT infrastructure implementation in government can make an important contribution from both a theoretical and a practical point of views.

1.3. Research Problem

Information infrastructure research is an area of IS research that has recently received considerable attention. This is due to the emergence of large infrastructure systems, including cloud computing platform technology. The publication of recent scholarly work

in this area of research (e.g: Aanestad et al. 2014; Constantinides et al. 2014; Reimers et al. 2014; Rodon et al. 2015) has further emphasised its importance. In the same vein, the Journal of the Association for Information Systems dedicated two special issues to research in this area in the publication years 2009 and 2014.

Information infrastructure is defined as a 'shared, open (and unbounded), heterogeneous and evolving socio-technical system consisting of a set of IT capabilities and their users, operations and design communities' (Hanseth et al. 2010). This definition shows both the emergent and the structural properties of information infrastructures that differentiate information infrastructures from their constituent elements. These authors define emergent properties as the shared, open, and evolving features of information infrastructure, while structural properties relate to the controlling nature of information infrastructure and its recursive nature and involve the negotiation of standards. Examples of information infrastructure can be a nationwide health information systems, airline systems, criminal justice systems, and the internet (Hanseth et al. 2010).

Research into the process of implementing information infrastructure has identified many issues that should be considered when contemplating the introduction of large IT infrastructure. These issues include (for example), tension between standardisation and flexibility (Hanseth et al. 2006), tension between top-down and bottom-up governance (Constantinides et al. 2014), local and global standardisation (Silsand et al. 2014; Star et al. 1996), the paradox of control (Nielsen et al. 2006), the paradox of change (Braa et al. 2007), bootstrapping issues (Hanseth et al. 2003), and legitimation (Constantinides et al. 2014). Studies into these issues have typically focused on the creation and operation of standards. They largely adopt social science approaches influenced by the social studies of science and technology to reveal the interplay between socio-technical factors in information infrastructure creation and operations (Hanseth and Moneteiro, 1997; Hanseth al 1996; Hanseth & Lyytinen, 2006).

These studies have largely adopted a micro perspective that focuses on the technical details of standardising information infrastructure. The macro perspective that considers the institutional arrangements and contexts that impact information infrastructure standards adoption have been overlooked (Iannacci 2010). This is despite calls that invite IS researchers to engage with institutional theory, as it is conceptually rich and suits the examination of complex social phenomenon (Currie 2009). Other researchers have

stressed the important role that the institutional context and forces can play in systems adoption and implementation (Avgerou 2000; Currie and Guah 2007). The context of institutional forces that seek isomorphism via information infrastructure needs further exploration. Institutional isomorphic mechanisms or institutional forces are cornerstones of institutional theories that focus on the stability of institutions. Adopting this perspective may provide a complementary, macro-level lens that has been overlooked by information infrastructure research focusing on the role of institutions.

One of the newly emerging forms of information infrastructure is cloud computing (Tilson et al. 2010b). It has been proposed as a solution for building common information infrastructure for organisations. The National Institute of Standards and Technologies (NIST) defines cloud computing as 'a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction' (NIST 2009). It has also been defined as a new way to manage resources on the internet by using different technologies to meet the needs of the organisation (Weiss 2007). Even though there have been many definitions of cloud computing, they all agree on the principle that most users or entities want to maximise the use of IT solutions without having to manage the complexity of IT technologies and without increasing costs.

When considering the services that cloud computing offers, three types of services can be identified (Armbrust 2010). These are Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). These services are offered through public, private, or hybrid cloud computing (Armbrust 2010). This research focuses on the first type of service, IaaS. IaaS is the latest in the line of cloud computing services, and although it is still evolving, it is the most promising type available. It is the closest model to the concept of computing as a utility, in which clients pay only for the computer processing power they have used (Iyer and Henderson 2010). Cloud computing looks like a solution to many of the issues identified for information infrastructure that were described above.

With the rapid emergence of cloud computing, different studies have considered factors affecting the successful implementation of this form of information infrastructure. However, few of these studies have addressed how this technology can be implemented

in different settings (Alshamaila et al. 2013; Melin et al. 2014). Less scholarly attention has been given to the implementation of government's cloud computing (G-Cloud) (Paquette et al. 2010; Pokharel et al. 2009). G-Cloud is one of the emerging types of cloud computing. Different governments have launched initiatives to adopt G-Cloud systems. In 2012, for example, the UK government initiated G-Cloud services to allow its organisations to benefit from internet-based computing and reduce their investment in hardware and software (UK.gov 2013). The US government has initiated a Federal Cloud Computing strategy to help its agencies to manage the demand for increasing online services and to provide highly reliable, innovative services quickly despite resource constraints (Kundra 2011). Despite its diffusion, there is currently little research on how government adopt cloud computing.

To address the gap in the literature, this study explores the adoption of government G-Cloud initiatives by investigating the implementation stage of the adoption of the National G-Cloud Programme in Oman. IS studies use various approaches to define and explore implementation. This study adopts a broad view of adoption where implementation presents a stage of a long journey of technology adoption that starts with adoption decision and ends with technology in-use. This view sets the boundaries between system implementation and system use where this study covers the implementation stage of the G-Cloud adoption. The use of the G-cloud or of other systems migrated to it, and the consequences of G-cloud implementation and use are outside the scope of this research.

1.4. Research Scope

This research examines the implementation of IaaS by the government of Oman. It particularly examines the cloud computing model of IaaS, and the focus of this study is the implementation aspects of cloud computing in government. It is positioned within systems implementation research and, in particular, infrastructure implementation in government. The relationship between government entities outside the implementation is out of scope for this research. Therefore, e-government research that considers citizens and business are out of scope for this study. Previous research on e-government has considered infrastructure as a catalyst for its diffusion (Brown and Thompson, 2011). It has also examined how the flexibility of information architecture in e-government chains can be achieved (Bekkers, 2009). However, this thin strand of

research has not considered how this infrastructure could be implemented in the first place. The research adds to the very few studies that examine infrastructure in government (Bekkers, 2009; Brown and Thompson, 2011).

The research examines an embedded case study of government cloud computing (G-Cloud). The main case study under examination is the programme sponsored by the Information Technology Authority of Oman (ITA), which is shown in figure 4.2 (adopted from Yin, 2014). The methodology used by this research was a single case study with embedded units of analysis. The study answers the research questions given in the following section. This study is positioned within the area of IS implementation in the public sector. It is concerned with information infrastructure implementation, specifically cloud computing implementation in the government of Oman. It adopts the view of IS implementation that differentiates between IS implementation and its use. It also contributes to the very limited research on Government-to-Government (G-to-G) models; hence, e-government models such as Government-to-Citizen (G-to-C) and Government-to-Business (G-to-B) are not within the scope of this research.

1.5. Research Questions and Objectives

As noted above, studies of information infrastructure standards and standardisation have adopted a technical perspective and paid little consideration of the institutional perspective (Iannacci 2010). This is despite the fact that other types of IS studies have used institutional theory to explore issues related to diffusion, development, and implementation across the societal and industrial sectors (Avgerou 2000; Currie et al. 2009; Janssen et al. 2009; Weerakkody et al. 2009). More specifically, research have considered the institutional isomorphic mechanisms (institutional forces) that influence the adoption of IT in organisations (Currie 2012; Gozman et al. 2014; King et al. 1994; Liang et al. 2007). Drawing from previous IS research, it can be argued that institutional forces could present a valuable lens in explaining and understanding the implementation of information infrastructure standards in governments. This research, therefore, adopts the lens of institutional forces to examine the IaaS type of cloud computing in government. It aims to develop a framework that identifies the organisational practices which lead to the standardisation of information infrastructure in government. Accordingly, the overall research questions are:

- How do institutional forces affect the implementation of government cloud computing?
- What organisational practices can lead to the adoption and implementation of cloud computing in government?

To answer the above research questions and meet the research objectives, this study adopts a theoretical perspective, in particular, the concept of the institutional forces (DiMaggio et al. 1991) that lead to the adoption and implementation of G-cloud.

- First, this study conducts a comprehensive and detailed literature review covering general IS implementation in government, information infrastructure, and cloud computing. It explains in detail the concept of cloud computing, the types of cloud computing and the services it offers, the government cloud computing concept, and cloud computing implementation in the various countries.
- Second, it proposes a conceptual framework, based on the extensive reviews of the related literature, which helps to analyse the case study and identify the organisational practices of institutional forces which lead to the standardisation of information infrastructure.
- Third, it investigates the implementation stage of the National G-Cloud Programme in Oman as a case study.
- Fourth, it empirically examines the proposed conceptual framework with the organisational practice which leads to standardisation in the case of the National G-Cloud Programme in Oman.
- Fifth, it presents the study's findings by highlighting the role of institutional forces in implementing G-Cloud computing.
- Finally, it identifies the theoretical and practical contributions of this research.

1.6. Research Design

This study adopts a qualitative, interpretive embedded case study approach, as this offers the best fit for answering the research questions and gaining a rich understanding of the context of this research. Adopting this approach is important, as there is a dearth of research that investigates national government implementation of cloud computing from an interpretive perspective. The research design, data collection, and data analysis follow

the recommendations of Walsham (1998) and Yin (2014). The context of this case study is the Oman government as represented by its Information Technology Authority (ITA), and the unit of analysis is the different government agencies involved in the G-Cloud implementation project. The research design and data gathered to document this study are illustrated in the roadmap shown in Figure 1.1.

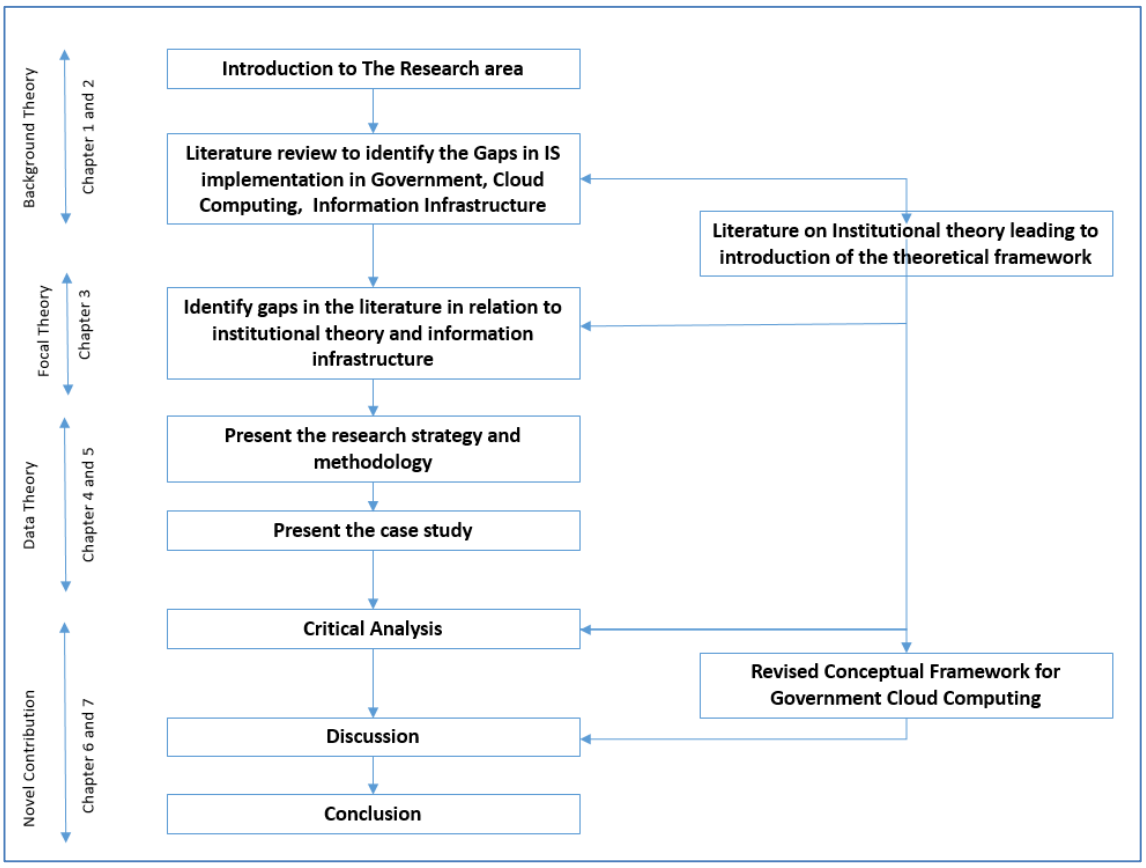

Figure 1-1: Research Road Map

Figure 1.1 shows the steps in how this research is designed. It starts with an introduction and a comprehensive review of the literature (Chapters 1 and 2) and then explains the theoretical framework of the research (chapter three). Next, a research strategy and case study protocols are presented (chapters four and five). Then, the case analysis and cross-case discussion are presented (chapters six and seven). Finally, built on the key findings, the practical and theoretical contributions are drawn (chapter eight). Having briefly addressed the model that guides the whole process of the research, the next section will explain the significance and the relevance of this study.

1.7. Thesis Structure

The thesis is made up of eight chapters and organised according to the recommendations of Phillips et al. (2010). Chapter One (this chapter) introduces the research background and outlines the broad field of study. This chapter aims to guide the reader by providing an overview of the rest of the thesis and lays its foundations. It includes a brief explanation of the research problem and background, the aims and objectives of the research, and a brief explanation of the research design. It justifies the importance, value, and originality of the research and finishes with a structural outline of the thesis.

Chapter Two aims to build a theoretical foundation for the research through a review of the existing relevant literature. It consolidates and collates the existing studies on IS implementation in government, cloud computing, and information infrastructure in Government. The examination of these areas of study establishes the boundaries and identifies gaps in existing literature. This chapter first reviews IS implementation in government by reviewing the literature of IS studies and focuses research into IS implementation in government. It then addresses cloud computing research in government and explores information infrastructure studies with particular reference to the area of standardisation in these studies.

Chapter Three presents the proposed conceptual research framework. The framework is based on extensive review of institutional theory and its application in the field of IS, more specifically in the situations related to information infrastructure studies. The research identifies the different organisational practices related to each institutional isomorphic mechanism, which in turn lead to the standardisation of information infrastructure.

Chapter Four explains and discusses the research paradigm followed by this research and outlines the methodology used. It describes the research approach and methods used to conduct the empirical investigation and explains the rationale for the study's research methods. The chapter also explains the data analysis methods used in this study and the criteria for judging its methodological rigour.

Chapter Five offers an overview of the context of the data collection. It describes the case study by providing information about the country in which this case study was conducted and the national organisation which adopted the National G-Cloud implementation

programme in Oman. The chapter then introduces the four government agencies that implemented and migrated their e-portals into the G-Cloud.

Chapter Six shows the key research findings of the empirical investigations of the case study of each of the government agencies that adopted the G-Cloud for their e-portals.

Chapter Seven discusses the analysis of the case studies, examining the coercive, mimetic and normative institutional forces and offers an in-depth interpretation and discussion of the main findings of the research. Based on the data interpretation, this chapter discusses how the proposed conceptual framework and institutional forces lead to cloud computing standardisation in the implementation stage of the Oman's National G-Cloud Programme. This chapter also discusses the implications of the findings of this research in the cloud computing and information infrastructure studies.

Chapter Eight concludes with a summary of the thesis. It underlines the key theoretical and practical contributions of the research and ends by acknowledging the research limitations and identifying areas for further study.

1.8. Chapter Summary

This chapter has laid the groundwork for this thesis. It started by introducing and justifying the research problem and research issues of IS and then laid out the study's aims and objectives. It briefly described the research design, addressed the significance of the research, and outlined the contents of the thesis. The next chapter will review and synthesise the related literature.

2. Chapter Two: Literature Review

2.1. Introduction

This chapter aims to provide a critical review of the scholarly literature related to the context of this research. It presents a critical review of the IS implementation in government literature, cloud computing research in government, and information infrastructure literature, and. The objective of the research is to answer the research questions: How do institutional forces affect the implementation of government cloud computing? and what organisational practices can lead to the adoption and implementation of cloud computing in government?

According to Webster et al. (2002), a good literature review creates a firm foundation for future research. The literature review assists theory development by identifying where there is no further requirement for research and where a gap exists that creates the potential for further research. From the IS perspective, Keen (1991) proposed that literature on the implementation of information systems in organisations has great theoretical and practical potential, as it can identify issues to improve future system implementation efforts. Rowe (2014) endorsed the importance of literature reviews in IS by stating that 'literature reviews strive to identify theoretical biases and thematic gaps and propose some corresponding stimulating research directions, and not just stop at the summarising/synthesising stage'.

The first part of this chapter reviews studies of IS in government. It explains the relationship between IS and government and how this relationship has evolved at different times. This research is about the adoption and implementation of G-cloud and not about e-government or the relationships between governments, their customers, and their suppliers using electronic systems (Means et al. 2000). Hence, the typical concerns of different e-government services including Government (G2G), Government-to-Citizen (G2C), and Government-to-Business (G2B) activities (Yildiz 2007) is out of the scope of this research as it maintains a focus on G-Cloud adoption and implementation[1].

The second part of the chapter discusses the concept of cloud computing and the different studies that have explored this concept. It explores the information infrastructure

[1] Appendix C provides an overview of the literature of e-government studies.

literature by looking at how different authors have identified and explored this area. These studies have also made findings about the concept of standardisation in information infrastructure implementation. In the last section, this research looks at the different gaps that are identified in information infrastructure and cloud computing research. It explains why it is important to explore these gaps and how this research will fill them.

2.2. IS Implementation in Government

Early studies of IS regarded technological issues in government as a marginal concern rather than a core management function. They saw technology as a means to manage the limitations of bounded rationality and provide the infrastructure for better decision-making (Simon 1976). Early government work on IS discussed isolated systems and was often intended to improve the performance of specific administrative functions, programs or activities. A multitude of government agencies established computer systems for record-keeping, financial and personnel management, printing, and other internal operations (Aldrich et al. 2002). Usually developed in isolation by different government agencies, these were stand-alone, legacy systems where Government agencies developed internal computer systems that were independent of and not inter-operational with other systems (Aldrich et al. 2002). However, with the advent of the internet and the huge advances in network bandwidth, these government IT systems have progressed and started to integrate with each other. Today's faster broadband has also been studied to find its relationship with IS innovation in government (Bygstad et al. 2007). National governments encouraged their agencies to adopt new IS initiatives and integrate with each other to provide better services to their citizens. In the US, for example, the National Performance Review (NPR) report was introduced in 1993 to improve government performance and enhance citizen access to government and other information services and resources. The introduction of the NPR resulted in the 'reinventing government' movement. One of the important results of the NPR is the creation of a one-stop, all-inclusive government portal, currently named as 'firstgov' (Aldrich et al. 2002). These kinds of initiatives have been introduced by many government organisations in many countries. With the introduction of initiatives like these, many types of research into information system and governments has been conducted.

IS implementation in government has been discussed from the national level (Avgerou et al. 2009; Cats-Baril et al. 1994; Chan et al. 2008b) or focusing on a particular area such as health (Aanestad et al. 2011; Braa et al. 2007; Jensen et al. 2009). It considered implementation perspectives (Chan et al. 2011; Chan et al. 2008a; Heeks 1999; Moon 2002), and also social, political and economic dimensions (Avgerou et al. 2007; Avgerou et al. 2001; Fountain 2001). Studies related to IS implementation in government have increased with the introduction of the internet and the availability of online services (Chen et al. 2007). As private companies started to provide online services, more pressure was placed on governments to enhance services for its citizens and business. Implementing IS in government has not been a straightforward process; it faced difficulties and challenges which in turn were investigated and studied by many researchers (Dwivedi et al. 2015; Heeks 2005; Heeks et al. 2007). Researchers have explored IS implementation in governments by examining what makes implementation successful in general (Almajali et al. 2016; Cats-Baril et al. 1994; Dwivedi et al. 2015), developing frameworks for success in developing countries (Gichoya 2005), success factors and project management (Rosacker et al. 2008), proposing a comprehensive framework to understand IS implementation in government (Fountain 2001; Sun et al. 2015), or by providing implementation strategies (Peppard et al. 2016; Poon et al. 2017).

At the national level, Cats-Baril et al. (1994) studied the successful implementation of a national IT infrastructure, examining how building such an advanced infrastructure could provide a national competitive advantage. The authors found that a number of factors can lead to successful implementation of a national infrastructure.

1. At the political level: willingness from the stakeholders
2. At the regulatory level: monopoly of the basic services and networks, subsidising start-up costs, free distribution of terminals, a long-term perspective of a company's services as an investment, and ability to establish and enforce a single standard
3. At the technical level: the ability to develop and implement a state-of-the-art telephone and data-transmission network, an easy-to-use interface, an inexpensive terminal, and a transparent billing system that ensured anonymity; and
4. Intuitive understanding.

These four factors were apparent in the French telecom company's understanding of the dynamics involved in network externalities. The authors recommended. The authors recommended that other governments should benefit from this successful implementation (Cats-Baril et al. 1994).

Gichoya (2005) studied the factors affecting IS implementation at the national level in developing countries and categorised them as drivers, enablers, barriers, or inhibitors. This study reviewed case studies from both developed and developing countries and preliminary studies were grounded in the e-government reality of Kenya. Through a descriptive framework, an action plan for success was proposed that included suggestions for enhancing the impact of success factors, decreasing the impact of factors for failure, and drawing on available good practice (Gichoya 2005). Another study explored the national broadband development in South Korea(Choudrie et al. 2004). The study investigated how the country achieved high broadband penetration with short span comparing with other countries. It found that different factors contributed to this development such as government leadership, high competition which resulted also in low price, highly educated and technology savvy culture, and geographic and demographic characters (Choudrie et al. 2004).

Rosacker et al. (2008) studied public sector information systems' critical success factors using a project implementation profile (PIP) framework for both the project implementation process and as a diagnostic instrument for a project manager. The study found significant differences in critical success factors between private and public sector IT projects. The authors believed that the findings of the study could be a useful guide for government information project managers as they seek to understand the key steps and processes that must be addressed throughout the lifecycle of an IT implementation project.

Another study explored how correctly managed IS can help to reinvent the government (Heeks 1999). The author proposed a management model for IS in government based on a review of international experience that offered practical guidance and insight for practitioners as well as researchers. The model identified various critical success and failure factors of reforms based on information and communications technology (ICT). It helped to identify the factors that should be considered if government organisations want to adopt IS-based reform (Heeks 1999).

Although researchers need to understand the success factors of IS implementation in government, this does not answer the 'how' and 'why' questions or explain the issues facing IS implementation in government. One well-known study of IS implementation in government was conducted by Fountain (2001) in her book *Building the Virtual State: Information Technology and Institutional Change*. She developed a technology enactment framework (TEF) to offer a complete and more powerful explanatory framework than the partial theories she reviewed. Her framework was applied in three different case studies in the US to explain the relationships between organisational forms, institutional arrangements, and IT use in government agencies. Her study found that both bureaucratic structure and the behaviour of key actors shapes technology enactment and identifies outcomes. Her framework has been used by many researchers to study IS in governments (Cordella et al. 2010; Luna-Reyes 2005; Stea et al. 2006). Other researchers extended the framework to include the different actors that they believed influence government implementation of IS (Schellong 2007).

Calls by different scholars for greater theoretical development of IS system implementation in government, for example, Heeks et al. (2007), have encouraged researchers to contribute in this area. Chan et al. (2008a) introduced an e-government implementation framework to be used as a descriptive tool to shape and organise various e-government initiatives and as a structure to plan and strategise e-government implementation. This framework offered an interpretive analysis of e-government related implementation initiatives undertaken by the Singapore Government. Information content, ICT infrastructure, e-government info-structure, and e-government promotion are the four main components in the implementation of e-government identified by Chan's study (Chan et al. 2008a). Sethi et al. (2008) used the framework developed by Chan et al. (2008a) for a case study of the successful implementation of e-government in Dubai.

Avgerou et al. (2007) study of the Greek public-sector computerisation project explained its IS and organisation change actions using the rational techniques of professional practice. The authors argued that the power dynamics of an organisation and the rational techniques and social context of its IS practice and closely connected, with each requiring the other to be sustained.

Landsbergen Jr et al. (2001) explored the issue of interoperability between government organisations by data sharing. The authors' findings reveal a strong need for an infrastructure to support interoperability through technical, policy architecture, and institutional information sharing. The authors argued that there is no centralised rules can be flexible enough to support the information needs of the diverse policy networks in an information age as they should be self-generated. What is important is to introduce a firm structure on which these networks can develop their own rules, standards and build interoperable systems. (Landsbergen Jr et al. 2001).

Jensen et al. (2009) conducted an empirical case study of electronic patient records (EPR) in healthcare units. The findings addressed the concept of implementing EPRs at three levels: the organisational field, the organisational/group level, and the individual/socio-cognitive level. Their study shows how the rationalised myth of a well-organised EPR system has moved from the organisational field to different units and individual doctors. A rationalised myth is an institutional context that is often veiled as a rational argument. The term used by organisations to maximise their legitimacy and rise their resources and survival capabilities (Meyer et al. 1977). The findings of Jensen et al.(2009) study also provide good evidence for the role of human agency by showing how doctors enact their work practices and shape the use of the EPR system (Jensen et al. 2009).

Recent studies related to IS implementation in governments have continued exploring different issues with the emphasis on new technologies or new government frameworks (Khan 2015; Ohemeng et al. 2015; Sun et al. 2015). Other recent studies have explores issues related to developing countries (Chatfield et al. 2015; Majdalawi et al. 2015; Waller et al. 2015).

These studies have discussed the implementation of IS in government in general. Cloud computing presents a different type of technology that promises readily available standardisation that has to be adopted by different government agencies. There are little views on how this type of uniform service could be adopted on a national level. Therefore, there is a need for an in-depth study that investigates how cloud computing infrastructure is being adopted and implemented by governments. This technology is anticipated to help government agencies to overcome implementation challenges related to the standardisation of the systems. The literature on government implementation shows

that while implementing large information infrastructure is always complicated (Star et al. 1994), many governments are implementing information infrastructures to provide better services by using the latest technologies available. This creates the need for information infrastructure research to converge with the fast-growing IS implementation of cloud computing services by national governments.

2.3. The Concept and the Categories of Cloud Computing

Many national governments in developing and developed countries have recently recognised the value of cloud computing and taken steps to adopt it. According to a KPMG (2012) report, public sector organisations are very interested in cloud-based systems to manage their restricted resources and enhance their services to citizens and businesses. Countries such as the US, the UK, and Australia already have cloud computing strategies and have started initiating cloud services for public organisations.

Cloud computing is an emerging form of information infrastructure (Tilson et al. 2010b). Many governments see cloud computing as a solution to the complex problems of developing large IT infrastructure (Gratner 2014). This section provides an understanding of cloud computing by discussing its basic concepts and describing its different types and the services they offer.

2.3.1. The Concept of Cloud Computing

The National Institute of Standard and Technology (NIST) has defined cloud computing as ‘a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction’ (NIST 2009).

Different authors defined cloud computing. Youseff et al. (2008) were among the first authors who attempted to provide a comprehensive definition of all aspects of cloud computing. This study uses the definition of cloud computing proposed by Youseff et al. (p. 21) as ‘a new computing pattern that allows users to utilise computing infrastructure

over the network, supplied with a variety of services and selection of the cloud provider at one or more levels of abstraction.'

Weiss (2007) anticipated the concept of cloud computing as a new way to manage the resources of the internet by using different technologies to meet the needs of organisations. According to these definitions, most users and organisations want to maximise their computer use without having to manage the complexity of IT technologies. They, therefore, seek ways to minimise the complexities of managing technologies.

The core concept of cloud computing is not new. Cusumano (2010) claimed that it dates back to the 1960s and 1970s when smaller companies bought computing time from larger enterprises who were able to afford mainframe computers. The cloud concept did not develop with the evolution of ICT mainly due to the limitations of network bandwidth. However, with the development of the internet and significant network expansion, the cloud computing concept started to grow in the 1990s and 2000s. Services such as e-mail and calendars at an individual level became common. Companies recognised the opportunities offered by cloud computing and started to make services available to other organisations. Amazon was the first organisation known to use the term 'cloud computing' to define one of its services (Amazon 2006).

Cloud computing is based on a set of capabilities such as distributed and grid computing and virtualisation (Armbrust 2010). From the business perspective, it can also be seen as a form of outsourcing IT services to meet a range of objectives, not the least of which is cost saving (Choudhary et al. 2013). In traditional IT-service outsourcing, the value chain is usually divided into the areas of infrastructure, applications, and business processes, which can be complemented by strategy and consulting activities (Leimeister et al. 2010). This concept is also the main driver for national government cloud computing implementations.

2.3.2. Cloud Computing Types and Services

Cloud computing offers three types of services: Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) (Armbrust 2010; Creeger 2009; Durkee 2010).

Software as a Service (SaaS**)** refers to business systems that are delivered as a service using the internet (Armbrust 2010). The users of the service should not have to update their software or maintain the application, and clients might have no knowledge of the physical location of the application and their data (Armbrust 2010). For example, the SaaS model has a payment mechanism where the client pays the provider for the service they use on a pay-as-you-go model and for keeping the application up and running (Farah 2010).

Platform as a Service (PaaS) means that cloud computing users can develop their own environment and use software that they have developed (Armbrust 2010). The infrastructure includes servers and operating systems that are not managed or controlled by the users but remain under the control of their application development and software-related applications. Google and Salesforce are good examples of PaaS that provide an environment for programming languages that can be used to develop new externally hosted applications (Shivakumar and Raju 2010). This kind of service is good for customers who do not wish to invest in their own platform.

Infrastructure as a Service (IaaS) is the first layer and the foundation of other of cloud computing services, where the client leases the infrastructure required to meet the needs of an application or for business continuity (Armbrust 2010). IaaS warrants study because it is evolving as the latest and most promising line of cloud computing. It comes closest to the model of computing as a utility where clients pay only for the computer processing power they use (Iyer and Henderson 2010). IaaS usually offers the operating system on a server or servers including a specific computing power and storage capacity, while providing some control over the network such as choice of firewall and denial of service protection measures (Durkee 2010). It has been widely implemented by the public and private sectors. IaaS will form the focus of this research because it is the first layer of implementation and the first form of implementation for many government agencies. Once IaaS is stable and operating, PaaS and SaaS services can function better.

According to Armbrust (2010), there are three main types of cloud computing: public, private, and hybrid. Different types of cloud computing, for example, community cloud, G-Cloud, or public cloud, can emerge to serve the interests of particular groups.,

Public cloud customers have no control or view of the infrastructure and where it is hosted. Vendors facilitate sharing the computing infrastructure between their clients in different organisations to provide the service in a cost-efficient way. Cloud computing providers who offer their services over the internet include Salesforce.com, Google App Engine, Microsoft Azure, and Amazon EC2 (Petkovic 2010). The private cloud works best for organisations who are concerned about the security of their data and who do not wish to share their data with other organisations. An organisation can own it itself or lease it from a vendor to serve only that organisation; the service covers the private network and the organisation's firewall. Two types of the private cloud can be identified: an on-premises cloud hosted internally within an organisation, and an off-premises cloud hosted outside the organisation but for its sole use (Petkovic 2010).

Hybrid cloud is a combination of private and public clouds, where an organisation can host selected applications and services in the public cloud and keep other services in a private cloud. The organisation, however, needs to keep track of which services are public and which are private. Integrating the private and public cloud services makes management of the hybrid cloud more complicated. This type of cloud is suitable for organisations who have their own internal set-up and legacy systems and will face challenges in becoming public, but who require cloud services for cost-saving or efficiency purposes (Petkovic 2010).

A community cloud is a subset where a group of organisations with common interests join to benefit from the cloud computing facilities but are not interested in sharing services with unrelated organisations (Mell et al. 2011). A community can be any group and may include (among others) the health industry, the banking sector, education entities, or government organisations.

2.4. Cloud Computing in Government

This section explores the national cloud computing initiatives of different countries and then examines cloud computing studies in governments.

2.4.1. National Cloud Computing initiatives

National governments build their private clouds, identified as G-Clouds, to encourage government agencies to adopt new technologies without investing heavily in their infrastructure. Many countries have launched G-Cloud initiatives, including the UK and the US. The US federal G-Cloud is one of the biggest examples of a private cloud. It was built on Terremark's Enterprise Cloud platform and has allowed the government to rapidly deploy specific applications. Examples of these include Forms.gov (for all federal forms), the topical Cars.gov (for the so-called 'Cash-for-Clunkers' programme), and Flu.gov, all of which are all linked to the government's official USA.gov web portal (Marston et al. 2011).

The US government also initiated a federal cloud computing strategy to help its government agencies to cope with the IT demand and provide highly reliable, innovative services quickly despite resource constraints (Kundra 2011). The country's shift has been fast, starting with the use of Google Mail and Google Documents and extending to the migration of Recovery.com, making it the first government to move into the cloud in April 2010(Kundra 2011). Governments have adopted the G-Cloud instead of using a public cloud to overcome challenges such as security issues and data lock-in. The G-Cloud allows them to maintain control of the operation of cloud computing and at the same time take advantage of the services that cloud computing offers. Depending on their rules, regulations, and needs, other types of cloud are being used by government organisations in different countries (Chandrasekaran and Kapoor 2011).

The UK government initiated G-Cloud services in 2012 to allow its departments to benefit from internet-based computing and reduce the need to invest in their own hardware and software (UK.gov 2013). The initiative is thought to have saved the UK government £340m by 2015 (Zelkowitz 2013).

Australia has also announced its National Cloud Computing Strategy, which aims to utilise and benefit from cloud computing in government; encourage cloud computing for small business, not-for-profits and consumers; and support a vibrant cloud services sector (KPMG 2012). Similar initiatives in countries like Canada, China, Turkey, and Malaysia are becoming common (KPMG 2012). Moreover, various recent reports started to rank countries in term of cloud computing related initiatives. For example, one of the recent reports ranked different counties based on most supportive claimants for cloud computing

(BSA 2016). The Software Alliance (BSA) produced a report of top 10 nation which supports the development and establishment of cloud computing climates based on data privacy rights, promoting standards, fighting cybercriminals, and enabling robust infrastructure. Japan, United States, and Germany were amongst the top 3 on the list (BSA 2016).

These initiatives by different national governments have been encouraged by the market rhetoric of cloud computing's ability to solve complexities and save costs by implementing large information infrastructures in government organisations. The initiatives indicate that governments have a very positive attitude to this kind of implementation, and there is a wealth of literature about information infrastructure that discusses the complexities involved in implementing such large infrastructure. These complexities are greater when different government agencies are involved.

The next section explores cloud computing research in government. Cloud computing is then discussed from the perspective of the information infrastructure literature to investigate the market rhetoric of cloud computing and show how it is in line with the information infrastructure literature.

2.4.2. Cloud Computing Research in Government

The amount of research on cloud computing reported in main information management journals is limited. A search was conducted in the journals of MIS Quarterly, Information Systems Research, European Journal of Information Systems, Information Systems Journal, Journal of Information Technologies, Journal of Strategic Information Systems, Journal of Management Information Systems, Information and Management, and Information Technologies & People. The objective of this search is to identify studies about cloud computing using the keyword 'cloud' which found only five articles. More articles related to cloud computing were retrieved from a search of the AIS Electronic Library (AISeL) (Bhat 2013; Hetzenecker et al. 2012; Leimeister et al. 2010; Li et al. 2012).

Early studies of cloud computing focused on its technical aspects, particularly in the area of grid computing and virtualisation. Other articles described the type of services and offerings and the business benefits of the cloud (Buyya et al. 2010; Creeger 2009; Youseff et al. 2008). Studies of the cloud can be classified as either definitional or factor-based. Within each category, different authors have examined particular phenomena with a practical focus, contributing to the overall concept.

Early articles reported more descriptive research and focused on defining cloud computing, describing its benefits and challenges and identifying different types of service (Buyya et al. 2010; Creeger 2009; Youseff et al. 2008). Youseff et al. (2008) were among the first to establish a detailed ontology of the cloud, describing the different layers of cloud classification and the relationships between them. They explained that few articles had attempted to establish the structure of cloud computing and its components. However, their classifications tended to more general than specific (Youseff et al. 2008). The description of cloud computing by Armbrust (2010) made reference to hundreds of researchers who had adopted these descriptions. The author proposes that cloud computing terms should be accompanied by simple figures to quantify comparisons between cloud and conventional computing and to identify its main technical and non-technical advantages and disadvantages. Armbrust identified cloud computing as being 'the applications delivered as services over the internet and the hardware and systems software in the data centres that provide those services' (Armbrust 2010).

Few of the early studies have investigated the business value of cloud computing, viewing it from different perspectives. For example, some studies identified the key players in the cloud business and future cloud strategies from the vendor's perspective (Bhat 2013; Hoberg et al. 2012). Others approached business values from the perspective of organisational or individual clients (Hoberg et al. 2012; Leimeister et al. 2010; Marston et al. 2011). The role of government as a policymaker and regulator is another perspective (Marston et al. 2011). Specific areas of business have also been studied, such as healthcare (Giniat 2011) and Customer Relationship Management (CRM) implementation (Petkovic 2010). All the above studies focused on describing the cloud rather than providing an in-depth analysis of how it might affect the business environment or the users.

Recent studies have used various IS theories, models, and frameworks to investigate different variables in cloud computing (Alassafi et al. 2017; Chang et al. 2016b; Chou

2015; Gangwar et al. 2015; Jones et al. 2017; Sabi et al. 2016). As cloud computing is an emerging phenomenon in IS studies, many researchers have studied the factors involved in adopting cloud computing at either the organisational or individual level (Chang et al. 2016a; Chang et al. 2016b; Gutierrez et al. 2015). Bhattacherjee et al. (2014) discussed migration theory and IS to draw attention to the emerging phenomenon of cloud computing by presenting a model of end-user migration from client-hosted computing to cloud computing. This study identified the salient factors that enable or hinder cloud migration: push factors where users are not satisfied with client-hosted systems, or pull factors where they find the cloud platform superior to local platforms. Other factors, such as cost changes and individual differences, can discourage users from migrating to cloud-based systems. Another study looked at cloud computing as an emerging form of IT outsourcing that requires organisations to work on their sourcing process (Schneider et al. 2014). The authors argued that the majority of cloud sourcing decisions are based on technological factors, and there is a need to identify the determinant factors of sourcing decisions in the cloud computing context by linking the IT outsourcing literature with the cloud computing literature. Schneider and Sunyaev's work can help practitioners in selecting or offering cloud services and identifying challenges they may encounter during these services' adoption, acquisition or integration.

In the manufacturing and service sectors, a study by Oliveira et al. (2014) investigated the determinants of cloud-computing adoption by using the diffusion of innovation (DOI) theory, developing a model based on the innovation characteristics and the technology-organisation-environment (TOE) framework. The study found that relative advantage, complexity, technological readiness, top management support, and firm size have a direct positive effect on a firm's adoption of cloud computing (Oliveira et al. 2014). The findings confirmed that when compared with the high-tech, finance, supply chain, logistics, and education sectors, manufacturing and service industries have different drivers in cloud computing adoption. These include gauging the competitor's cloud strategy and changes in government regulations (Oliveira et al. 2014).

Another study used institutional factors to investigate the adoption of cloud computing in India (Bhat 2013). The authors used different sizes of cloud computing transaction costs and used the inhibitors of IT adoption to identify the institutional factors that encourage cloud adoption by Small and Medium Enterprises (SME)s (Bhat 2013). That study differs from this research by focusing on SMEs in India and looking at cloud computing from an

economic perspective. It also compares the transaction cost of cloud computing with the inhibitors of IT adoption by SMEs. A recent s study looked investigated the contradictory, conflicting, and paradoxical forces which are shaping the Chinese cloud computing market and industry form institutional and economic perspective (Kshetri 2016). The author believes that policy interventions along with progress in key areas such as IT penetration, availability of the bandwidth, and the supercomputing industry and local research and development activities, the cloud would gain momentum and hold a promise to bridge the digital divide(Kshetri 2016). Moreover, another study aimed to understand the adoption in the Norwegian public sector (El-Gazzar et al. 2015). The study explored field level changes which produced different isomorphic coercive, normative, and mimetic pressures. The government agencies responded to these pressures differently as they established in their strategy for adopting cloud computing. They did that through adopting a public cloud or by developing their own private cloud infrastructure(El-Gazzar et al. 2015). Another recent study focused on the adoption of cloud computing in two different countries (El-Gazzar et al. 2017). The study used a neo-institutional lens to understand the internal and external factors and how they influence on shaping CC adoption strategies. The study identified five external institutional factors which are governments and regulatory bodies, cloud service providers, media, socio-political changes, and culture.

Güner et al. (2014) explored cloud computing adoption factors in Turkey as an example of the practice in less IT-mature countries. The results show the factors enabling the adoption of cloud computing as cost, distributed organisational structure, the mobility of employees, and end-user satisfaction. Security, critical business processes, loss of control over systems and data, and the broadband infrastructure of the region were the inhibitor factors that made companies cautious about cloud computing (Güner et al. 2014).

Li et al. (2012) considered cloud computing from a different perspective. While most studies had explored cloud computing from national or organisational levels, their study examined how individual users accept cloud computing to satisfy individual needs. The authors examined factors that influence individuals' intention to use the cloud. These influential factors are based on the theory of planned behaviour, the technology acceptance model, computer learning theories, and social and economic exchange theories. Their study showed that a person's attitude, norms, and behavioural control have direct impacts on that person's behavioural intention to use the applications. However,

personal beliefs about the risks and benefits of cloud applications also have indirect impacts on behavioural intention. (Li et al. 2012). Their research was modelled on multiple theories: the theory of planned behaviour, the technology acceptance model, computer learning theories, and social and economic exchange theories.

Another interesting study used a stylised model (a mathematical model) to analyse the effect of cloud computing on an organisation's structural decision to make the IT department either a cost centre or a profit centre (Choudhary et al. 2013). The literature shows a variety of results, and these have managerial implications. The study found that when the cloud vendor faced intense competition, the cost-centre organisational model was preferred over the profit-centre model. Moreover, when the cloud vendor had pricing power, a profit-centre organisational structure was likely to be preferred. The profit-centre structure provided greater internal quality enhancement to cloud-based IT services than the cost centre (Choudhary et al. 2013). This study can help national governments to decide whether their cloud computing system to become for-profit or not-for-profit.

Although the studies noted above helped to find that different factors that contribute to the success of cloud computing related implementation, they miss the issue of how and why this technology evolves or becomes successful in various settings. Yang et al. (2012) explained that adoption of cloud computing is a major concern to the practitioner community, and there is urgent demand for articles explaining cloud computing from different management perspectives. This is why it is important to look at cloud computing from the interpretive perspective. Little interpretive cloud computing research was located during this research. An example of interpretive studies is conducted by Melin et al. (2014). The authors used the theory of institutional legitimacy to investigate how IT fashions influence the legitimacy of IT decision-makers in implementing cloud solutions. They used an in-depth longitudinal case study of two universities in two different countries. They concluded that IT fashions can benefit an organisation as well as harming it. Fashions may improve or degrade the legitimacy of policymakers and cause shifts in their view of IT technologies.

It is evident from the above studies of cloud computing that there is a dearth of qualitative interpretive research. There are limited if any, studies in major IS journals that use an interpretive perspective to investigate the implementation of cloud computing by a national government.

One noticeable omission is a discussion of the wealth of literature addressing information infrastructure and the cloud computing phenomena on the one hand, and the often contradictory rhetoric of cloud computing on the other. The market rhetoric of cloud computing promises simple and straightforward implementation coupled with the adoption and acceptance of standards that cannot be contested. However, information infrastructure research paints a different picture. It reveals the complexity and negotiated nature of large information infrastructure and the paradoxical need for both control and flexibility (Hanseth et al. 2004; Sanner et al. 2014). There is a need to understand the implementation and adoption of cloud computing in practice and provide insight to research and organisation communities into the adoption and implementation of standards for large information infrastructure.

Cloud computing is also considered by some to be a disruptive technology (Bhat 2013; Choudhary et al. 2013) that is an alternative or an adjunct to in-house IT services. Others believe that it has not yet reached a level of maturity; there is a lack of conformity to industry-specific standards and a high level of related risks and costs (Oliveira et al. 2014). This makes looking at large infrastructure technology a potentially fruitful research area. At the same time, an important gap that needs more study is national IaaS implementation in the government sector where different government agencies (multiple sites) are implementing their application within the national IaaS. Pollock et al. (2010) have identified the theoretical and methodological weakness of many information infrastructure studies and particularly short-term and single-site studies. A study which considers different organisations within a national IaaS would make an important contribution to information infrastructure studies.

2.5. Infrastructure as a Service (IaaS) in Government

This research focuses on IaaS as one type of cloud computing offering. It is attractive to many government agencies as a first step in experiencing cloud services (KPMG 2012). Many national governments are adopting and promoting this service to their government agencies. Cloud computing is a new form of information infrastructure and is having radical effects on industries and their boundaries (Tilson et al. 2010b). For example, the introduction of new cloud computing services will enable groups and organisational units to adopt technologies and new applications that internal socio-technical complexities

previously made difficult to access (Tilson et al. 2010b). By enabling cloud services, organisations are able to launch IaaS without the complexity of buying and installing new hardware. Organisations can buy online storage or an Amazon web service account without incurring the costs of new hardware.

National governments are now adopting and implementing cloud computing based services to reduce costs and to help their local government agencies to implement IS(BSA 2016). Consolidating and collaborating large information infrastructure systems for all government agencies can be a challenging task (Akbar et al. 2015; Bankole et al. 2015; Gal et al. 2008). Information infrastructure literature shows the many technical and socio-technical complexities of dealing with large, and complicated infrastructure (Aanestad et al. 2011; Hanseth et al. 1997; Henningsson et al. 2011). Since cloud computing is at the forefront of information infrastructure (Tilson et al. 2010b), it is valuable to explore the challenges it presents. Reviewing the literature of information infrastructure is most relevant to this research. The next section will do this by looking at the different information infrastructure definitions and the development of information infrastructure standards.

2.5.1. Definitions of Information Infrastructure

The term 'information infrastructure' is an extension of the word 'infrastructure'[2]. Infrastructure is defined in the Oxford Dictionary as 'The basic physical and organisational structures and facilities (e.g., buildings, roads, power supplies) needed for the operation of a society or enterprise: the social and economic infrastructure of a country' (oxford dictionary). Some definitions of the elements of infrastructure include a set of elements to support functionality in the form of large, complex resources that are shared among different communities. Hanseth et al. (1998) proposed that there are no clear boundaries demarcating the 'outside', and the line separating the core characteristics of infrastructure from more marginal functions is always negotiable.

[2] A comprehensive search conducted of leading IS journals between 1990-2016 to identify the relevant literature in the area of Information Infrastructure. A total of 64 articles retrieved from *MSIQ*, *ISR*, *EJIS*, *ISJ*, *JIT*, *JSIS*, *JMIS*, *Information and Management*, *IT&P*, and *JAIS*. The citations in each article were followed up, to expand the scope of research. Web of Science was used to search for who had cited these articles and if they could add to the literature.

Information infrastructure is synonymous with many terms used in early studies, including the ‘infobahn,’, ‘information highway’ and ‘electronic highway’ (Hanseth et al. 1996). Information infrastructure has been defined using different names. Although the term ‘information infrastructure’ is widely used, many studies mention digital and e-infrastructure. These three terms describe the same concept and differ only because of the different points of view of academics, practitioners, politicians, and the public. Theoretical terms are often employed to assert understanding and control of systems that have always proved far more uncontrollable in practice than on paper, or that exist mainly in the imagination of their designers, builders, and managers (Edwards et al. 2009).

Studies of information infrastructure started in the 1990’s with the advent and ubiquitous use of the internet (Ciborra et al. 1998; Hanseth et al. 1997; Hanseth et al. 1996). These early studies, however, do not mean that information infrastructure studies were a major part of IS research studies. These have focused, in general, on IT governance, system development, and the effect of IS on individuals, groups, organisations, and markets. Compared with overall IS research, research into information infrastructure has been limited (Sidorova et al. 2008). For example, one study that looked at articles published in Information Systems Journal and MIS Quarterly during the past 20 years revealed that only about two percent of articles focused on infrastructural issues (Tilson et al. 2010b). Tilson et al. (2010a) explained that the lack of interest evidenced by the dearth of well-published examples and the huge obstacles in studying large-scale complex phenomena do not fit with many IS researchers’ techniques. The weak theoretical understanding of information infrastructure as a new form of IT has also contributed to the lack of published work (Tilson et al. 2010a). Formerly, information infrastructure was assumed to be relatively isolated and stable, and issues of infrastructural change could be rationally and operationally separated from the ongoing issues of IT design, use, and governance (Tilson et al. 2010b). The convergence of digital and information infrastructure has accelerated in recent years, and a new, generative dynamic of information infrastructure has emerged (Henfridsson et al. 2013). As a result, information infrastructure studies have become much more acceptable. This has encouraged researchers to study information infrastructure from different viewpoints, including macro-level perspectives.

Information infrastructure has been defined by several authors. Tilson et al. (2010b), for example, identified information infrastructure as a group of technologies and human elements, networks, systems and processes that contribute to the functioning of an

information system. Hanseth et al. (2010) identified information infrastructure as 'a shared, open (and unbounded), heterogeneous and evolving socio-technical system (which we call an installed base) consisting of a set of IT capabilities and their users, operations and design communities.'

This study adopts the definition proposed by Hanseth and Lyytinen (2010), as it recognises both the structural (Controlled nature) and the emergent properties (shared and open nature) of information infrastructure as distinct from its constituent elements. It provides a clearer definition of than those of other authors, it incorporates the socio-technical concept of information infrastructure' and is both broad and inclusive.

Different themes have been explored by information infrastructure studies. Earlier studies of information infrastructure tended to focus on ways to conceptualise information infrastructure (Monteiro et al. 2014). These studies conceptualised different topics in information infrastructure, such as design (Pipek et al. 2009; Star et al. 1996) and standards (Hanseth et al. 2006; Hanseth et al. 1997). Some studies attempted to conceptualise information infrastructure based on contrasts between the local and the global (Ribes et al. 2009; Ure et al. 2009) and between system design and system implementation (Braa et al. 2007). Other studies discussed new ways of understanding information infrastructure and developed new language and plans for understanding and conceptualising information infrastructures (Sahay et al. 2009; Ure et al. 2009). These studies assert that information infrastructure needs to address multiple locales, phases, and timescales. Among others, Pipek et al. (2009) studied the practice of developing information infrastructure from the stages of designing, implementing, and using it to the stage of revising and further developing it.

Recent studies of information infrastructure, the second generation of information infrastructure studies as identified by Monteiro et al. (2014), have tended to go beyond snapshots of particular moments in information infrastructure development. These studies involve multiple moments and long-term trends. Studies of this kind can be seen as a response to a call by Pollock et al. (2010) that underscored the theoretical and methodological weakness of many studies that achieved popularity by relatively short-term and single-site examination of technology implementation.

Recent studies have also explored theoretical, methodological, and practical outcomes, where information infrastructure has been used as a tool of analysis, or more specifically,

as providing guidelines for intervention (Monteiro et al. 2014). For example, a study by Silsand et al. (2014) contributed to the early stage of design and the development of generic systems, in this case, a large-scale electronic patient record (EPR) system. Their study showed how a vendor resolved infrastructural challenges by learning from local practice, translating perspectives, and carefully adjusting the design strategy over time. It made three recommendations: vendor flexibility in evolving systems, user-developer collaboration at the early stages of a development project, and project management participation in recruiting clinical personnel and clinicians to take part in the project. More very recent studies, have explored Information Infrastructure from digital innovation process (Bygstad et al. 2017; Nambisan et al. 2017). For example, Bygstad et al. (2017) explored how an innovation process initiative in complex e-health context can successfully interact with underlying digital infrastructure. While these studies explained the role of information infrastructure as a guideline for intervention, it is important to explore how information infrastructure systems such as IaaS have been used as a tool of intervention in different sites. For example, while national governments allow government agencies to benefit from the cloud computing offers such as IaaS, they have also imposed their standards and rules on those agencies in different locations and different socio-technical settings.

2.5.2. Information Infrastructure Standards Implementation

Earlier studies of information infrastructure were shaped by modern infrastructure projects such as electricity grids (Hughes 1987). This stream of the study saw information infrastructure as a stable, supportive way to ensure competitiveness in the era of the new 'information superhighway' (Tilson et al. 2010b). This view describes the stable characteristics of different physical equipment and steady connectivity with universal access to information infrastructure. Studies from this perspective focused on the technical standards of information infrastructure to ensure that systems are interconnected across different platforms and have stable performance. Some studies also recognised the importance of information infrastructure being generative. The generative nature of information infrastructure means that it is recursive, scalable, and flexible. At the same time, it is important to realise that information infrastructures do not grow easily (Hanseth et al. 2010; Star et al. 2006) but wrestle with the resistance of the installed base and are

constrained by the strengths and limitations of that base. In the space between these two aspects of information infrastructure, stability (control) and generativity (evolution), many studies have discussed different issues. Striking a balance between the stability and generativity has been an area of research for many information infrastructure studies.

The issue of standards has been studied by many scholars (Braa et al. 2007; Hanseth et al. 2006; Hanseth et al. 1996; Lyytinen et al. 2006). A standard defines a 'uniform set of measures, agreements, conditions, or specifications between parties (buyer-user, manufacturer-user, government-industry, or government-governed, etc.)'(Spivak et al. 2001). Technical standards offer agreed external points of reference with which the physical and performance characteristics of current or future technologies can be compared (Spivak et al. 2001). Standards are critical to the existence of information infrastructure. Different parties can only communicate if they share common standards, such as languages, protocols, or technical terms. David et al. (1990) differentiate between three kinds of standards: reference standards, minimum quality standards, and compatibility standards. Information infrastructure standards can be best described through compatibility standards, as these ensure that each component follows a standard interface specification and can, therefore, be successfully integrated into a larger system (Hanseth et al. 1996). Standards can also be classified according to the processes by which they are established, where a distinction is often made between formal, de facto, and de jure standards (Hanseth et al. 1996). Hanseth distinguished between these three, explaining that 'Formal standards are worked out by standardisation bodies. Both OSI [Open Systems Interconnection] and internet are formal according to such a classification. De facto standards emerge when technologies are standardised through market mechanisms, and de jure standards are imposed by law'(Hanseth et al. 1996).

Many studies have explored the implementation of information infrastructure standards by considering the elements of control (Hanseth et al. 1996), flexibility (Bekkers 2009; Hanseth et al. 2006), evolution (Henfridsson et al. 2013), design (Hanseth et al. 2003; Nielsen et al. 2006), and bootstrapping (Hanseth et al. 2010). Although these elements are identified separately for this research, most studies have examined two or more elements and addressed the tensions or relationships between them. These tensions can be categorised as control versus evolution (Braa et al. 2007; Ciborra et al. 2000; Hanseth et al. 1996; Tilson et al. 2010b), top-down versus bottom-up (Aanestad et al. 2011; Constantinides et al. 2014; Vaast et al. 2009), and local versus global (Braa et al. 2007;

Hanseth et al. 2010; Silsand et al. 2014). Identifying the main elements of information infrastructure standards separately will provide a better insight into how each of them has been explored in the literature. The next subsections will review some of the elements of information infrastructure standards that are related to this research.

2.5.2.1. Establishing standards

Standards are the technical basis for information infrastructure and regulate its communicative patterns. These standards are negotiated, developed, and shaped through complex social processes (Hanseth et al. 1997). Hanseth et al. (1997) explain that standards incorporate inter-organisational changes in the specific way they regulate communicative patterns. This means that the way standardisation activities are organised deserves closer examination, as it is an important element of the social process through which organisational networks are transformed (Hanseth et al. 1997).

Establishing standards has been a major theme in IS studies (Hanseth et al. 2006; Lyytinen et al. 2006) and information infrastructure studies (Braa et al. 2007; Hanseth et al. 2006; Lyytinen et al. 2006). This is due to the important role standards play in the evolution of information and communication technology (ICT). Establishing standards becomes increasingly important in developing and managing ICT services, where ICTs became universal, heterogeneous, networked, and complex.

IS literature has discussed the issue of establishing standards. Different studies have discussed contingent factors or historical events that influence the creation of ICT standards, and how these contribute to their success or failure (Hanseth et al. 2006). Hanseth et al. (2006) argued that socio-technical complexity is a major factor in ICT standardisation efforts and showed how complexity creates reflexive processes that undermine standardisation aims.

Creating and implementing standards is complex and is not a straightforward process. Hanseth et al. (1997) observed that standards are neither ready-made nor neutral. They are continually being developed, and they 'inscribe' behaviour in complex and non-transparent ways. The authors argued that the socio-technical complexity of establishing an information infrastructure is frequently severely underestimated by those involved. By linking one inscription to other inscriptions, the authors hoped to learn more about the strength of inscriptions, that is, the degree to which an inscription succeeds in enforcing the desired behaviour.

2.5.2.2. Design

Another element that has been discussed in information infrastructure research is the element of design. Standard setting and design can lead to the same concept in information infrastructure studies, as they both occur in the beginning stage of standards. Good design of information infrastructure offers substantial benefits for individuals, business, and society at large, as witnessed, for example, by the success of the internet (Hanseth et al. 2010). On the other hand, poor design results in huge losses in investment, opportunity, costs, and political and social problems; for example, the implementation of a nationwide e-health system in the UK (Sauer et al. 2007). An early metaphor for designing large-scale information systems was described by Star et al. (1996) as 'building the boat you're on while designing the navigation system and being in a highly competitive boat race with a constantly shifting finish line.' In information infrastructure terms, this can result in failure to produce the expected organisational infrastructural changes. Star and Ruhleder also recognised the challenges of designer-user communication. More recently, information infrastructure-related design challenges have included the difficulty of converting well-described information infrastructure evolution into effective socio-technical design principles to promote the coordination of their evolution, growth, and complexity. Nielsen et al. (2006) explained that controlled evolution as a design approach should be based on a deep understanding of the existing control/autonomy balance as well as the distribution of resources and risks and the ability and willingness to innovate.

Hanseth et al. (2010) have proposed a set of design principles and related design rules while 'observing pivotal relationships between technical and social elements, and their dynamic interactions' (p. 15). They used complex adaptive systems theory to draw up the design principles and associated design rules for information infrastructure. They put bottom-up adaptations centre stage, with IT designers and users pushing to create a self-reinforcing installed base.

2.5.2.3. Control

The prime objective of establishing standards is to ensure that information infrastructure is stable and controlled. Standards are essential if the information infrastructure is to be stable and to allow other systems to be installed on top of it. Studies of the control element argue that absolute control is impossible and only leads to drift and unintended outcomes (Ciborra et al. 2000). When control is imposed on government agencies, evidence of the

problems and failures of infrastructure development becomes apparent (Adler-Milstein et al. 2008; Currie et al. 2007). Other authors argue that an information infrastructure can never be completely controlled, as it continuously grows in complexity and deviates from original intentions (Ciborra et al. 2000; Hanseth et al. 2010; Sahay et al. 2009). Advocates of this argument argue that the changing circumstances of the market and the technological innovations within which infrastructures are implemented, together with user resistance and implementation side-effects (Hanseth et al. 2006), are likely to lead to more drift (Ciborra et al. 2000). Studies have argued that information infrastructures cannot be governed in a top-down fashion (Hanseth et al. 2010; Sahay et al. 2009) because of the dynamic complexity involved and the varying needs of different users (Hanseth et al. 2010). These arguments contradict the cloud computing promises that the centre can impose centralised and controlled standardisation on different government agencies.

2.5.2.4. Flexibility

While information infrastructures need to be stable to allow 'enrolment' of new artefacts, processes, and actors, they must have the flexibility to allow infinite growth. Flexibility is one of the main characteristics of information infrastructure that is 'unbounded, evolving, shared, heterogeneous, and open recursively organised a system of IT capabilities whose evolution is enabled and constrained by its installed base and the nature and content of its components and connections'(Hanseth et al. 2010).

Other studies have discussed the concept of flexible standards for information infrastructure developments. For example, Braa et al. (2007) proposed the concept of flexible standards as a key element in a sustainable infrastructure development strategy. This study built a case around the use of flexible standards as attractors to information infrastructure development, arguing that if they are well defined and simple, they will be able to adapt to the frequent changes that are experienced in the complex health environment. The authors suggested that two important strategies need to be followed to achieve this. First, focus on data standards and information rather than on technical standards. Second, accept that there will always be technically incompatible subsystems. Make them compatible for data exchange by building gateways between them. While technical standards cannot be uniformly replicated across an uneven, heterogeneous infrastructure, data standards can be replicated.

Another study notes the important role of flexible standards for information infrastructure as an enabler of organisational responsiveness and competitive advantage (Bhatt et al. 2010).

2.5.2.5. The importance of information infrastructure standards for this research

This research investigates the implementation a national cloud computing system that comes with a centralised logic of standard architecture. The centralised logic is intended to impose its standard on local government agencies that use the system. The literature of standards and standardisation in information infrastructure clearly emphasise the complexities of imposing standards, particularly with a top-down approach. Looking at an implementation case study that involves a cloud computing implementation can help in discovering whether this technology can add and contribute to the findings of information infrastructure literature discussed previously which highlighted the complexities of implementing standards.

2.6. The Top-down vs Bottom-up Approach to Information Infrastructure Implementation

Studies of information infrastructure have also discussed the tussle between implementing from the top down or the bottom up (Brown et al. 2011; Hanseth et al. 2010; Sahay et al. 2009; Vaast et al. 2009).

The top-down approach is preferred by senior executives or unit managers as a way to impose control. However, this approach is not always effective in practice for government-sector infrastructures (Constantinides and Barrett 2014). The literature presents real evidence of the problems and failures of centralised control in government infrastructure development (Adler-Milstein et al. 2008; Currie and Guah 2007). Studies have been conducted to tackle this tension between the two approaches. Constantinides et al. (2014) proposed a polycentric approach to governing infrastructure development through collective action framing. They suggested that governance roles should not be defined during the early stages of information infrastructure development, as this will trigger resistance from users who see it as being imposed from the top-down. Rather, senior managers should allow different entities to govern themselves as long as they do

not affect other layers. As these entities gradually reach a common understanding of governance, they will be able to move to the next layer. This suggestion has been called progressive nesting (Constantinides et al. 2014).

Conversely, advocates for the bottom-up approach argue that information infrastructures cannot be governed by a top-down approach (Hanseth and Lyytinen 2010; Sahay et al. 2009) because of the dynamic complexity involved. This complexity includes the expanding number of users' increasingly varying needs that can be an influence throughout information infrastructure design (Hanseth and Lyytinen 2010). The bottom-up approach works better in existing systems, although it is more resilient to future change and will normally lead to a less integrated national system (Coiera 2009). Grisot et al. (2014) argued that information infrastructure should be developed from the bottom up as users and entities experiment with their needs and progress gradually. This approach requires infrastructure and the organisation to be straightforward, flexible, and loosely coupled with other infrastructures and development organisations (Grisot et al. 2014).

2.7. The Gaps in the Literature

Cloud computing is rapidly transforming the IT landscape by promising to solve many of the challenges that ICT implementation faces, specifically in the government sector (KPMG 2012). Studying cloud computing from the information infrastructure perspective is essential as it is large, complex, and includes numerous system with users in different settings (Tilson et al. 2010b). The literature of information infrastructure has been reviewed in general and different elements of implementation standards have been examined. These elements are establishing standards, design, control, and flexibility (Braa et al. 2007; Ciborra et al. 2000; Hanseth et al. 2003; Hanseth et al. 2010; Henfridsson et al. 2013). These have been studied from different perspectives. However, these studies tackle particular issues within information infrastructure development, such as data standards and standardisation procedures, from a technical perspective at the expense of an institutional perspective (Iannacci 2010).

It is important to realise that the wave of information infrastructure evolution is not finished. It continues its journey as we see new waves of digitalisation, such as cloud

computing and web services. These new information infrastructure phenomena can cause radical changes in the way individuals, groups, and organisations coordinate and interact (Tilson et al. 2010a). For example, the national government is trying to overcome the complexities and challenges faced by its local government agencies by offering them cloud computing IaaS. The radical changes that come from using the emerging digital infrastructure of cloud computing can result in outcomes for individuals and organisations that were not anticipated by the previous literature. Looking at national level IaaS implementation with multiple sites (Pollock et al. 2010) fills an important gap. Previous literature has focused on cloud computing implementation on single sites.

It is also important to note that information infrastructures are now much less limited in the ways they can be integrated with other information infrastructures to form a foundation for services or even for other infrastructures. The growth of data bandwidth has allowed many dispersed locations to be connected easily. Better bandwidth has also led to the introduction of new types of information infrastructure services. These can have a disruptive effect by redistributing control away from the owners of the physical assets in organisations. These new services allow organisation or government agencies to recreate services and applications and develop new applications to overcome existing socio-technical complexities within their organisations. This can result in outcomes that were not previously achievable. Reconsideration of the previous literature in light of the new wave of digitisation by empirically testing new and potentially disruptive solutions like cloud computing is an important gap to be filled.

When looking to information infrastructure implementation in the government sector from the national level, it is important to examine the role of the central government in providing G-Cloud services and particularly IaaS. The IaaS offered to the users comes with a centralised logic of standard architecture. From an information infrastructure perspective, imposing this centralised logic on users from the top down without considering the users' requirements may produce problematic outcomes. Evidence of the problems and failures of centralised control in public sector infrastructure development from the top-down has been documented in the literature (Adler-Milstein et al. 2008; Currie et al. 2007). It is therefore important to investigate how a centralised IaaS approach using a new type of potentially disruptive technology can influence implementation. The outcome of this investigation can be compared with outcomes from the top-down

approach of previous IS implementations in government so that any differences will become apparent.

Information infrastructure research has brought a new perspective to the way IS practitioners think about infrastructure. People used to think about infrastructure as technical implementation: however, new perspectives of information infrastructure research can introduce socio-technical elements to their thinking. However, it is apparent that institutional perspectives of information infrastructure have not been sufficiently studied. When considering the role of institutions in information infrastructure implementation, it can be seen from the information infrastructure literature that there is a dearth of knowledge in this area of research. The previous research linking information infrastructure theory with the institutional theory is limited and has not identified the new approach of the centre in imposing national standards as a gap (Brown et al. 2011; Iannacci 2010).

Finally, it would be valuable to explore how organisations have interpreted the market rhetoric of cloud computing as a new form of information infrastructure and allowed it to be adopted and implemented. This will also allow an understanding of why organisations allow the centre to impose its standards on them. A new type of Informational Infrastructure and standardisation is coming from outside the organisation without regard for its installed base and history, and the end users (agencies) are told that the change is not evolutionary. Looking at information infrastructure from the perspective of institutions and how this influences IaaS implementation would make an important contribution to information infrastructure research.

2.8. Conclusion

This chapter outlined the literature related to the research question. First, it explored the research on IS implementation in government and pinpointed the research gaps in this area. It also surveyed the literature of e-government, found a link between e-government studies and information infrastructure studies, and discussed national cloud computing implementations in government. The second part outlined the concept of cloud computing, reviewed the research into it, and identified the gaps in this area. The third part of this chapter reviewed the information infrastructure literature and addressed some

of the different themes in it. It discussed the importance of studying information infrastructure standardisation and found gaps in this area. Finally, this chapter detailed the important gaps to be covered by this research. The next chapter will focus on the theoretical approach that will guide this research.

3. Chapter Three: Theoretical Framework

3.1. Introduction

The previous chapter critically reviewed the relevant literature associated with this study and discussed IS implementation in government, cloud computing research in government, and information infrastructure research in relation to the research questions. This chapter aims to review the use of institutional theory in IS research, in particular in information infrastructure studies. It then identifies institutional isomorphic mechanisms or institutional forces and uses these mechanisms as the theoretical lens to understand the case study. The term 'institutional forces' will be used for remaining chapters to identify the isomorphic institutional mechanisms.

This chapter is divided into ten main sections. Section 2, after this introduction, provides a justification for using institutional theory. Section 3 and 4 explains the concepts of institutional theory and the three mechanisms of institutional forces. Section 5 explores the studies of institutional theory and government, and in particular how the literature of IS in government utilises institutional isomorphism. Section 6 explores the information infrastructure literature that uses institutional theory and addresses institutional forces. Section 7 explains how this research will use the three institutional forces to explain government implementation of a national IS such as G-Cloud. Section 8 presents the different organisational practices that the researchers associated with the three isomorphic mechanisms. Section 9 highlights the limitations of using institutional theory for research. Section 10 is the conclusion of the chapter.

3.2. Justification of the Use of Institutional Theory in This Study

Researchers' objective in seeking the institutional perspective is to find a means for taking into account the irrationalities emerging within institutional contexts that surround organisational actors (Avgerou 2000; Orlikowski and Barley 2001; Teo et al. 2003). In this perspective, the actor follows norms to seek legitimacy more than efficiency (Tolbert and Zucker 1999). This research uses institutional theory to find the influences of the adoption and implementation of certain technologies in an organisation (Orlikowski and Barley 2001). Institutional forces have been used in various IS studies to explore different phenomena and case studies (Avgerou 2001; Gosain 2004; King et al. 1994; Liang et al.

2007). Institutional forces have been used to discuss the adoption phase (Teo et al. 2003), and the post-implementation phase (Liang et al. 2007). The significance of institutional forces lies in determining the legitimacy of organisational forms or missions and determining the elements that should be considered in the choice of technical rational actions (Avgerou 2001). This study builds on previous studies which suggest that new institutional logics stemming from institutional forces are likely to come into conflict with old or existing logics (Currie 2004; Currie 2012; Currie and Guah 2007; Swanson and Ramiller 1997).

Many studies have investigated information infrastructure implementation challenges; however, most of these studies addressed it from the approach of information infrastructure development, such as the data standards and technical standardisation perspectives, and less attention has been given to the institutional perspective (Iannacci 2010). Institutional theory is complex, as it has to deal with interactions between the central agency and subsidiary agencies and vendors. Studying information infrastructure from an institutional perspective is important because there is limited systematic consideration of the influence of the broader institutional perspective on the form and dynamics of information infrastructure, even though such an assessment would have immediate implications for information infrastructure policies. Monteiro et al. (2014) emphasise that studying information infrastructure from institutional theory perspective can be a major enhancement to examining 'what scope exists for proactive information infrastructure interventions, policy, and governance—and how these may vary under different information infrastructure forms and settings' (Monteiro et al. 2014). Studies that use institutional theory in the IS field have generated criticism from the IS community as being conceptually rich but empirically impoverished (Hasselbladh et al. 2000). Hence, studies which empirically use institutional theory will make a valuable contribution to the IS literature.

While adopting institutional theory in this study, it is recognised that different theories are used to examine information infrastructure. The theories used in information infrastructure studies are actor-network theory (Fomin 2003; Hanseth et al. 2006; Hanseth et al. 1997; Hanseth et al. 1996), complexity theory (Braa et al. 2007; Hanseth et al. 2006), relational model (Armstrong et al. 1999; Vaast et al. 2009), diffusion of innovation theory

(Cats-Baril et al. 1994; Kettinger 1994; Racherla et al. 2013), and institutional theory (Iannacci 2010; Racherla et al. 2013)[3].

3.3. Institutional Theory

The origin of institutional theory dates back to the traditions of sociological works on organisational structure that were initially driven by empirically testing and developing the general logic of functionalist social theory (Merton 1948). These empirical testings laid the foundation of sociological studies of organisations that led to the study of bureaucracy in management. Organisational research then shifted focus in the late 1960s to include consideration of the effects of environmental forces in determining structure (Tolbert et al. 1999). This work was the foundation of institutional theory.

Institutional theory has been used by many researchers to study organisations and develop further theoretical perspectives. Some studies used institutional theory to examine the power within the organisation (Selznick 1949; Weber 1946). These studies started by explaining earlier works conducted by social exchange theorists and political scientists (Scott 2001). For example, Merton (1948), discussed various aspects of the bureaucracy and behaviours of the organisation. Advancing these ideas, other researchers have developed concepts related to the organisation's environment, including intra-organisational relations and relationships between organisations (March 1965; Simon 1965). With these thoughts, the agenda for many researchers begin to focus on sociological studies of organisations (Scott 2008). The concept of institutional theory started with the question of why unrelated organisations that have been developed in different environments are similar in structure.

Institutional theory has gained momentum in the social sciences since the early 1990s despite ongoing ambiguity about concepts such as institutions, institutionalisation, and institutionalism (Currie et al. 2009). Jepperson (1991) made an effort to clarify these concepts and offered the following definitions related to institutional theory. He defined an institution as 'a social order or pattern that has attained a particular state or property'; institutionalisation 'denotes the process of such attainment'; and institutionalism is 'a

[3] Appendix D gives a review of the different theories used in information infrastructure research with justification of why it is not used in this research.

theoretical strategy that features institutional theories and seeks to develop and apply them' (Jepperson 1991). Two additional concepts have emerged in institutional theory literature (Jepperson 1991). Deinstitutionalisation is 'the erosion or discontinuity of an institutionalised organisational activity or practice' (Oliver,1992, p. 563), and re-institutionalisation represents an 'exit from one institutionalisation and entry into another institutional form organised around different principles or rules'(Jepperson 1991).

3.3.1. Institutions and Organisations

The two key concepts used in management studies are institutions and organisation. Scholars have defined an institution as a social structure that is made up of a group of individuals or organisations within which collectives act in a controlled (DiMaggio et al. 1983; Meyer et al. 1977; Scott 2001). Based on earlier definitions of the institution, Scott (2001) characterised institutions as 'social structures that have attained a high degree of resilience. [They] are composed of cultural-cognitive, normative, and regulative elements that, together with associated activities and resources, provide stability and meaning to social life'. The author adds that institutions are diffused by various types of carriers such as symbolic systems, relational systems, routines, and artefacts. Additionally, institutions function at different levels of control, from the world system to localised interpersonal relationships. Institutions by definition mean stability but are subject to change processes, both incremental and discontinuous. Veblen (1906) suggested that institutions act as a 'habit of life, particularly with the changes which the modern era brings in industry and the economic organisation of society.' Accordingly, organisations are a social arrangement that, within the framework of institutions, follow collective goals and have separating boundaries from their environment and control their performance (Scott 2001).

With the introduction of these conceptual foundations, the concept of organisation institutionalism was established between 1977 and 1983 with seminal works by Zucker (1977), DiMaggio et al. (1983), Scott et al. (1983) and Zucker (1983). Previously, early researchers had treated organisations as a general social issue. However, Merton and his students Philip Selznick, Parsons, Simon, and March changed to more focussed analyses of this field of studies (Scott 2001).

With new business settings, 'institution' has become a broader term with more complicated arrangements, rules and mechanisms to realise core business objectives

(Scott 2008; Tolbert et al. 1999). Zucker (1977) argued that 'Institutionalisation is both a process and a property variable… Institutionalised acts, then, must be perceived as both objective and exterior'. Merton, on the other hand, argued that the idea behind the term 'organisations' widely represents independent social actors in modem societal processes (Weber 1946). Researchers, including Weber (1946) and Michel (1962), suggested that the main role of formal organisations is to act as potential creators of new institutional structures. Researchers in the field of institutional study (e.g., Merton, 1948; Selznick 1949; and Gouldner 1954) suggested that the need to study organisations becomes apparent when there is a need to develop the general logic of functionalist social theory, and this can be performed only by empirically testing a phenomenon (Tolbert et al. 1994). Accordingly, organisations give the opportunity for researchers to conduct much comparative research with different focuses. However, such research needs an empirical examination of different issues related to organisations (Selznick 1949; Tolbert et al. 1994).

Organisations work to achieve specific goals that are crucial to organisational structure, and every action within the organisation must be consistent with the main objectives of the organisation. Selznick (1949, p. 256) stated that 'Because organisations are social systems, goals or procedures tend to achieve an established, value-impregnated status.' Selznick also suggests that once goals and procedures become accepted by the organisation, they become institutionalised. Tolbert et al. (1994) identified two main issues when empirically studying organisations: examining the nature of different elements of organisational structure and assessing the stability of beneficial outcomes of a given organisation.

Drawing on the first concern of Merton (1948), for any organisation to achieve its business objectives and attain success the entire structural components of the organisation's system must be integrated and interrelated. However, change in any structural component within the system will result in other changes in the overall system (Merton, 1948; Tolbert and Zucker, 1994). Secondly, the stability of the beneficial outcomes of the given organisations, wherein this point the existing structures provide the social system's functioning with the balance results that are continually efficient (Merton, 1948; Tolbert and Zucker, 1994).

Understanding these two concepts is important, as this research focuses on changes in organisations and the adoption and implementation of an information infrastructure by one organisation over other government agencies.

3.3.2. Old and New Institutionalism

Different researchers have offered various definitions for explaining the concept of institutional theory. Authors such as DiMaggio et al. (1991), Hirsch et al. (1997), and Schneiberg et al. (2005) proposed a distinction between the old and the new institutionalism. They wanted to underline the importance of the symbolic system and mental maps that provide guidelines for behaviours (Scott 2008). The old institutionalism was developed in the 1940s and 50s to focus on local aspects (Selznick 1949). The new institutionalism developed in the 1970s with the publication of papers considering the role of the macro environment on organisations (Meyer et al. 1977). The publication of *The New Institutionalism in Organisational Analysis* (DiMaggio et al. 1991) and *Institution and Organisation* (Scott 2001) made significant contributions to the regeneration of the study of institutions in the social sciences. (DiMaggio et al. 1991) stated that:

> The new institutionalism in organisation theory and sociology comprises a rejection of rational-actor models, an interest in institutions as independent variable, a turn toward cognitive and cultural explanations, and an interest in properties of supra-individual units of analysis that cannot be reduced to aggregations or direct consequences of individuals' attributes or motives. (DiMaggio et al. 1991).

They also explained that institutions differ from one area to another, and they place (in order of importance) micro and macro aspects, normative and cognitive elements, and the role of interests and relation networks in the diffusion of institutions.

These two most important definitions clearly explain how institutionalism is a complex field. Institutionalism is relevant to a range of core disciplines, including economics, sociology, political science history and ecology (Scott et al. 1983).

3.3.3. Neo-Institutionalism Flavours

New institutionalism has four different flavours: rational choices institutionalism (RI), historical institutionalism (HI), sociological institutionalism (SI), and discursive institutionalism (DI) (Schmidt 2008). The first three of these, RI, HI, and SI, have been used more to explain continuity than change. Each of these new institutionalism flavours focuses on different aspects. RI focuses on rational actors who pursue their preferences following a 'logic of calculation' within political institutions. DiMaggio (1998) defines this as the rules of the game that include laws, inherited organisational structures, and norms. In this study, RI means that centralised standardisation from a central body should induce a positive reaction of adoption in the agents who are expected to implement these standards.

SI originated in sociology and gained support among political scientists. It deals with socially constructed patterns, norms, values and culture which influencing actors and agencies (DiMaggio 1998). SI focuses on social agents who act according to a 'logic of appropriateness' within political institutions, defined as socially constituted and culturally framed rules and norms (Schmidt 2010). The third flavour of new institutionalism, HI, explains the development of political institutions, which are defined as regularised patterns and routinised practices subject to a 'logic of path-dependence'(Schmidt 2010). It focuses on explaining the present institutional arrangements and forecasting the future based on previous experience and established norms and culture.

Neo-institutionalist scholars following the three neo-institutional flavours have mainly explained change coming from the outside as the result of exogenous shocks. This explanation is shaped by the definition of institutions, which they describe as given, static, and constraining (Schmidt 2010). The fourth neo-institutional flavour is 'discursive institutionalism' (DI). This flavour of institutionalism describes the homogeneity among the wide range of scholars who use ideas and discourse to explain political change (and continuity) in an institutional context. It uses the role of ideas and discourse in institutional forces to explain how institutions occur (Schmidt 2010). Discursive institutionalism, therefore, shares a core focus on the significance of institutions with the other forms of neo-institutionalism but varies in its definition of institutions, in its objects and logic of explanation, and in the ways in which it interacts with change (Schmidt 2010). Different works have used DI to study government (Kromidha et al. 2017; Schmidt

2005; Wueest et al. 2015). For example, Kromidha et al. (2017) used DI to study how projects, as drivers of digital innovation, could mediate between change and stability in the context of the Albanian government. The findings of the study recommend that large information infrastructure government projects cannot be seen only as temporary events; they are rather strategic points of interaction between stakeholders where ideas can be converted to policies, programs, and philosophies to maintain the stability and change.

These different concepts of new institutionalism show that scholars have held different perspectives on institutionalism. Schmidt (2010) asserted that everything takes places through discourse. He proposed that rather than looking at values and norms, looking at discourse makes it possible to find different types of practices. Table 3.1 describes the different flavours of institutional theory described by Schmidt (2010). Considering institutional discourse adds valuable insight into how ideas interact through different government levels and projects (Kromidha and Córdoba-Pachón, 2017). However, other aspects of institutionalism can be also considered. Although Schmidt (2010) explored different flavours of institutionalism, including discursive institutionalism, there are other facets of institutionalism that Schmidt did not explore which are important to explain the implementation phenomena of government information infrastructure. These include the concept of institutional forces and the idea of institutional intervention, which are important to explain the phenomena of implementation by government (Brown and Thompson, 2011; Iannacci, 2010). Schmidt's (2010) argument is that traditional institutional theories consider institutions as objects that are external to agents, policies, processes, or norms, as they all can be considered as ideas in people's minds. However, he did not engage in explaining institutional interventions despite its importance (McGrath and Anyo 2010). Understanding the different institutional forces is important to this research, as it explains the role of institutions in effecting change (Hoffman 1999).

Table 3-1: Different flavours of institutionalism

	Rational choice institutionalism	Historical institutionalism	Sociological institutionalism	Discursive institutionalism
Definition	Structures of incentives	Regularised patterns and routinised practices subject to a 'logic of path-dependence'	Socially constituted and culturally framed rules and norms	Political change in an institutional context
Focus	Rational actors	Development of political institutions	Social agents	The ways in which institution interact with change
Explains	Continuity	Continuity	Continuity	Change

Source: (Schmidt 2010)

3.3.4. Research Focus on Institutional Theory

Reflecting on the growth of the research area of institutions, researchers argue that it is important to shift the focus from social problems to the more in-depth effects of environmental pressures to determine the formal structure, functions and related aspects of organisations (Meyer, 1979; Tolbert and Zucker, 1994; Teo et al., 2003; Scott, 2008:37). Institutional theory gathers together various aspects of organisations including the economic, political and social pressures contexts (Carroll and Delacroix, 1982; Teo et al., 2003). Returning to the effect of environmental pressure on the organisation, institutional theory utilises the coercive, normative, and mimetic mechanisms to explain different aspects of organisations (DiMaggio and Powell, 1983; Tolbert, 1985). These three mechanisms have been identified by many researchers, including DiMaggio and Powell (1983), Tolbert (1985), Tolbert and Zucker (1994), and Teo et al. (2003). The isomorphic mechanism is usually driven by either interconnected relations or structural equivalences. The following sections will discuss the various mechanisms of institutional theory, and later sections will relate these mechanisms to information infrastructure implementation in government.

3.4. Isomorphic Mechanisms of Institutional theory

Much of modern organisational theory seeks to explain variations in organisations' structure and behaviour (DiMaggio et al. 1991). The initial stages of an organisational field's life cycle display considerable diversity in approach and form, and once the field is well established, there is an inevitable push towards what is known as homogenisation (DiMaggio et al. 1991). Various case studies of organisations show the emergence and structuration of an organisational field by drawing on the activities of a diverse set of organisations to illustrate the homogenisation of established organisations and of new-entrant organisations once the field is established (DiMaggio et al. 1991). The concept of homogenisation is best described as isomorphism. Isomorphism can be identified as a process that forces one unit in a population to be similar to other units that face the same set of environmental condition (Currie 2012).

Another way to explain homogenisation is from an innovation perspective. As an innovation spreads, a stage is reached beyond which adoption provides legitimacy rather than improved performance. Strategies that are considered rational for some organisations may not be rational for others. However, if the strategies are normatively sanctioned, the chance of their adoption increases (Currie 2012). Hence, when organisations try to force changes beyond a certain point in the structuration of the organisation field, the aggregate effect of change within the specific organisation may be to constrain or weaken the extent or diversity of the field. This effect is called homogenisation or isomorphism (Currie 2012)

DiMaggio et al. (1983) explained three different types of institutional mechanisms by considering them as isomorphic mechanisms, and these can be categorised as coercive (or regulative), normative, and mimetic (culture cognitive). Both coercive and normative pressures are controlled by interrelated relations while mimetic pressure is controlled by structural equivalence (Teo et al. 2003). Interrelated relation imply the existence of transactions binding one organisation to another (DiMaggio et al. 1983). These transactions can include formal contractual relations, labour unions, boards of directors, participation in professional associations, or even informal organisational ties like personal flows. Structural equivalence implies the similarity of positions in a network structure (DiMaggio et al. 1983). Thus, two organisations may have ties of the same kind to the same set of other organisations even if they are not directly connected.

Scott (2001) viewed these mechanisms as three different models of institutions and called them institutional pillars. He added that 'Institutions are comprised of regulative, normative and culture-cognitive elements that, together with associated activities and resources, provide stability and meaning to social life' (p. 48). The author explained that these models are differentiated, as each identifies with a distinctive basis of compliance, mechanism of diffusion, type of logic, cluster of indicator, effective response, and foundation for legitimacy claims. Hoffman (1999) sought to capture the dynamics of institutions by seeing the three different isomorphisms as interacting with each other rather than being independent. Understanding the three different isomorphisms is important as it explains the interplay between various institutions that contribute to institutional change. This research adopts the theoretical perspective of institutional theory and in particular the isomorphic mechanism or institutional forces. These forces are reviewed in detail in the following subsections.

3.4.1. Coercive Institutional Force

Coercive institutional force is one of the three forces of institutional theory. It is a result of both formal and informal pressure imposed by one organisation on another organisation upon which it is dependent and by the cultural expectations of the society within which the organisations function (DiMaggio et al. 1991). DiMaggio et al. (1983) explained that organisation feel these pressures as force, persuasion, or invitations to join in a collision. Some organisations are obliged to change in direct response to a government order. For example, manufacturers may be obliged to adopt new pollution control technologies to conform with environmental regulations imposed by the government. Non-profit organisations are obliged to maintain accounts and hire accountants to meet tax law requirements, and organisations may employ affirmative-action officers to fend off allegations of discrimination (DiMaggio et al. 1983). Another example of this might be a national government that triggers change by mandating that its local government agencies impose new environmental requirements on petrochemical companies to reduce pollution.

Coercive pressures can be collections of rules, policies, procedures or collective agreements where the behaviour of every member of an institution is affected by the decisions of those who shape the institution's structure (Kondra et al. 2009).

3.4.2. Mimetic Institutional Force

When new organisation technologies are poorly understood, and when goals are not clear, and the environment creates uncertainty, organisations tend to model themselves on other organisations (DiMaggio et al. 1983). This behaviour is called 'mimetic behaviour'. The advantage of mimetic behaviour in the economy of human action is significant. When an organisation faces a problem with unknown causes or unclear solutions, a search may yield a viable solution that has been already implemented or tested by others (DiMaggio et al. 1983). This results in the organisation spending less by imitating other organisations' behaviours. A good example of a mimetic behaviour is Japan's effort to model the successful western governmental prototype, which in turn led to the successful governmental organisation in Japan.

This idea behind the powerful effect of mimetic pressure explains the culture cognitive mechanism by which external cultural issues can shape the internal processes of organisations in the same environment (DiMaggio et al. 1983; DiMaggio et al. 1991). Teo et al. (2003) proposed that the similar economic positions, industries, goals, objectives, challenges, conditions, and shared customers and suppliers are some of the key reasons for mimetic behaviour. These mimetic conditions occur in organisations to help them to reach the legitimacy level of the other organisation; control a wider social structure; solve challenges with an undefined solution; reduce the cost of research, testing and experiments; and avoid being the first to try a new experiment by benefitting from another organisation's experience (Toe et al. 2003).

3.4.3. Normative Institutional Force

Another group of theories sees institutions as resting mainly on the normative mechanism (Scott 2001). Many terms are used to describe this mechanism. For example, DiMaggio et al. (1991) used the term 'professionalisation' to define the normative force. The authors define the normative force as 'the collective struggle of members of an occupation to define the conditions and methods of their work, to control the production of future member professionals, and to establish a cognitive base and legitimisation for their occupational autonomy' (DiMaggio and Powell 1983, p. 152). The normative mechanism is a normal social action that considers particular types of processes or behaviours as

legitimate (Scott, 2001). It functions as a structure by imposing constraints on social behaviours. Scott continued by explaining that normative systems include both values and norms. Values can be defined as the individual's desires under the existing standard structures of the behaviours and attitudes of others, whereas norms describe how individuals are supposed to behave to achieve their desires.

These normative systems not only describe goals or objectives but also designate appropriate ways to achieve them (Scott 2001). For example, people who want to buy and sell properties normatively require commercial registration as real-estate agents by the state to legalise their activities and achieve their goals.

DiMaggio et al. (1991) emphasised that individual organisations have systems of norms and behaviours, and sharing these norms and behaviours with other organisations creates organisational behaviour and intensifies its influence. These norms and behaviours will later define the rules of the organisation (DiMaggio et al. 1991). As these normative behaviours develop, they significantly influence social actions by imposing constraints on social behaviours. These behaviours take the form political systems that signpost what people are routinely expected to do (Scott 2008). King et al. (1994) showed that the normative mechanism in organisations has a significant role in influencing their structure. By applying norms, those in power can control the practices, rules, and beliefs of those who are subject to an institution's systems.

A good example of normative mechanisms can be seen in the behaviour of university-trained professionals or graduates from similar universities. Because of their similar education and training, they have similar values and ideas of what they think it is proper. These will then be carried into an organisation, which then tends to favour the adoption of similar values and practices. For instance, IS graduates try to promote the use of technologies within their organisations, which then becomes standard practice for all members of that organisation.

3.5. Institutional Theory and IS in Government

Institutional theory has become an important set of concepts and ideas for research across the IS field. The contributions of the theory vary, as many studies use it to interpret and analyse data, and some seek to extend the theoretical understanding of institutionalism.

IS studies using institutional theory include the topics of adoption, diffusion, development, implementation, and structural changes across the societal and industrial sectors (Avgerou 2000; Currie et al. 2009; Jensen et al. 2009; Jones et al. 2016; Kurnia et al. 2015; Sharma et al. 2016; Weerakkody et al. 2009). Other research has examined the relationship between technology and institutions (King et al. 1994; Orlikowski et al. 2001). King et al. (1994), for example, utilised both the study of innovations and institutions and provided a synthesis of perspectives to assist research on the institutional aspects of IT innovation. Their study considered IT as an innovation and assessed the rationale for innovation based on economic and social principles, as well as the special role of institutions in innovation production and use. In a similar way, Orlikowski et al. (2001) suggested that to understand transformations in the nature of work and organising, researchers should consider both the technological changes and the institutional contexts that are reshaping economic and organisational activity. Interactions between the fields of IT and organisation studies should be considered as a matter of enrichment.

In the field of IS, institutional theory has been applied throughout different sectors, including the government. Different areas within government have been studied using institutional theory; some studies have used this theory to address national-level issues (Grimshaw et al. 2006; King et al. 1994) while others have used it to study a single organisation (Davidson et al. 2007; Gosain 2004). Government-related studies have also covered areas such as that of health. For example, Currie (2009) explored the National Health Service (NHS) in the UK as a case study that empirically tested institutionalist concepts rather than analysing the richness of institutional theory concepts to further develop and build the theory. The author argued that many variance models developed by various IS researchers used survey-based methods to test theoretical constructs within organisations, and these studies focussed mainly on the effects of institutionalism rather than observing the processes.

Some studies have used institutional theory to explain the changes in government resulting from the adoption and use of IT (Anstead et al. 2008; Fountain 2001; Hassan et al. 2008). One of the known studies of the institution was the technology enactment by Fountain (2001). Fountain focuses on the use IT and its effects on government organisation, mainly from the institutional perspective. The technology enactment framework allows a comprehensive analysis of the influence of organisational structure

and institutional arrangement on the use of technology for theory building (Schellong 2007).

3.5.1. Institutional forces in government:

To understand how governments perceive the occurrence and effects of institutional forces, this section provides an explanation of each institutional force through a government organisation perspective.

One example of the direct mechanism is the pressure exerted by the Ministry of Finance on a government agency to reduce its budget, which can be felt as force or mandate causing organisational change. An indirect mechanism can be the budget-reduction rules implemented by one government agency that can later be followed by another government organisation. DiMaggio et al. (1991) explained that when a government works to regulate an aspect of something, an organisation related to this aspect will mostly be influenced by the common legal framework. This standard legal framework will affect different dimensions of the organisations in their business domain to imitate most of this organisation behaviour, structure, and services. Similarly, in government IS projects governments commonly assign a single organisation to act as the regulator, to assist in implementing different phases of the project, and to develop a common information infrastructure (Chan et al. 2008a; Gupta et al. 2008). The responsibility that has been assigned to this organisation will allow it to use the same norms and rules when assisting other organisations to implement e-government. Pfeffer et al. (2003) explained that the success of an organisation in implementing new technology would ensure that the structure it adopted is accepted by other organisations and users.

With the normative mechanism, ICT initiatives and projects in government also rely on professionalisation (DiMaggio et al. 1991), and best practices (Liang et al. 2007). When any project is successful, its methods become best practice; this will impose normative force or pressure on other government organisation to do the same. For example, once the government produces one successful case of IS implementation, the normative force or pressure will appear which influences change on IS government initiatives as other organisation will follow. Burt (1982) argued that the normative mechanism is visible when an organisation adopts an innovation or new technology, and other organisations

within the same environment are likely to adopt similar innovations. Sharing new technologies will increase the desire of others to change and progress. In the government context, these norms will shape the way an innovative IS project is adopted and implemented, and at the same time promote best practice coordination between government units.

As mentioned earlier, organisations that share the same phenomenon in the same environment become isomorphic in their structure (DiMaggio et al. 1991). For government organisations, similarities in work procedures or isomorphic behaviour in the structure will result in similar services. However, they will still face problems caused by uncertainty about any new work process that is introduced (Davenport et al. 1994; Hammer et al. 1993).

Different studies have used institutional isomorphism to study IS in government (Currie 2012; Gozman et al. 2014; King et al. 1994; Liang et al. 2007). Currie (2012), for example, used the isomorphic mechanism and change within the highly institutionalised organisational field of healthcare by studying the National Health Service (NHS) in the UK. 10-year longitudinal analysis showed that isomorphic institutional conditions conflicted with an attempt to impose field and organisational change. The study found that attempts by clinicians, as key stakeholders, to retain their professional dominance conflicted with the political attempt to implement electronic health records. This conflict resulted in policy change and further delays in implementation. The study found that the procurement of technology used to occur at the local level, yet government policies required the NHS to save money and time and encouraged more standardisation of IT solutions. This led the NHS and the government to regulate healthcare through a number of centralised, top-down policy initiatives.

Another study by Gozman et al. (2014) was triggered by the global financial crisis of 2007-2009. Policy makers were pressured to introduce a new wave of regulations to address problematic practices with manual financial and procurement systems by replacing them with core investment management systems (IMS). The objective of the study was to explore the extent to which these IMS were able to change embedded practices. The study used a conceptual model to examine the relationship between displacement, institutional mechanisms, the research context, and persistent practice. The study found that ‘IMS encouraged responsible trading through surveillance, monitoring

and the automation of regulatory rules; however, it also suggested that the institutionalisation of technology-induced complaint behaviour was still uncertain'(Gozman et al. 2014).

Liang et al. (2007) investigated how senior management is able to mediate the impact of external institutional pressures on the degree of usage of enterprise resource planning (ERP) systems. The study asserted that institutional forces are essential for post-implementation assimilation when the integration process is prolonged, and outcomes are dynamic and unclear. This study discussed the post-implementation stage but not the use of an isomorphic mechanism in the implementation stage.

Sherer et al. (2016) explored the adoption of Electronic Health Record in a highly institutionalise industry of US health care using the intuitional theory. The authors' study shows the impact of the institutional effect of government policies and industry norms when adopting critical technologies. The study concluded that mimetic force was more critical when there was greater uncertainty. Moreover, the coercive forces were significant with US government established incentives, and the normative forces continually influenced adoption of the Electronic Health Record.

Another study explores the adoption and diffusion of a cross-culture Interorganisational Information System (IOS) (Hsu et al. 2015). The study discloses that the implementation of a cross-cultural IOS is an active process concerning the understanding and management of the regulative, normative, and cognitive challenges.

Other scholars have discussed the isomorphic mechanism as part of broader research studies. For example, Kim et al. (2009) used institutional theory as an analytical perspective to evaluate and document the development of an anti-corruption system called OPEN in the Seoul Metropolitan Government. The study investigated how an e-government system for anti-corruption in a regional government has evolved as the example for a national scheme to be used for the same purpose. The study was conducted by incorporating the three isomorphic mechanisms of institutionalisation (regulatory/coercive, cognitive/mimetic, and normative) and using four anti-corruption strategies embedded in the system, (Kim et al. 2009). Currie et al. (2007) studied the UK's NHS project by using institutional analysis of historical and empirical data from six NHS organisations. The study found a 'growing fragmentation in the organisational field of healthcare, as the past and present institutional logics both fuel and hinder changes in the

governance systems and working practices of healthcare practitioners'(Currie et al. 2007). The research also suggested that an understanding of large-scale government-supported IT change is possible only by applying the influence of regulatory, normative and cultural-cognitive factors.

3.6. Institutional Theory and Information Infrastructure:

Few studies have addressed information infrastructure research from the institutional perspective (Brown et al. 2011; Hanseth et al. 1998; Iannacci 2010). For example, Iannacci (2010) described the role that institutional facts play in the development of information infrastructures in public-sector projects. The author argued that previous approaches focused on more on the technical side of the installed base at the expense of the institutional installed base. The author also argued that when work practices and organisational routines are accounted for, there are limited, if any, references to institutional facts. This paper shows how institutional facts are entangled with data standards through iterative groups of fundamental rules. It shows how social institutions map onto corresponding technical artefacts into a layered patchwork of inter-tangled components. The author adds that 'Ultimately, the iterative nature of institutional facts accounts for the hierarchical structure of information infrastructures by which standards set at one level can serve as the basis for standards at a higher level' (Iannacci 2010).

Brown et al. (2011) discussed the use of infrastructure building and government intervention to help the diffusion of ICT in Jamaica and drew attention to the differences between developed and developing countries in their approach to e-government. The study used institutional factor analysis for IT innovation, a model introduced by King et al. (1994), to analyse the interaction of policy and practice of e-government in a developing country. Four important themes were identified that characterise the context for e-government policy together with the associated institutional factors. The three institutional factors of innovation directive, standards, and subsidy had the most influence on the four main themes identified by the policymakers as significant. The study used institutional factor analysis for IT innovation and stressed the importance of including policy-based intervention in a future research agenda for e-government in a developing country.

Another study investigated the importance of the institutional aspects of work practice and the infrastructural features of technology through a study of patient record systems in hospitals (Hanseth et al. 1998). The study examined how patient records are essential for the coordination and cooperation of an extensive collection of actors, both within and outside the hospital which is hard to change. The infrastructures in use were linked to a network of actions in a way that made them institutionalised, and they shared structural properties that made them hard to change separately as well as when they are considered a single unit which explains the failure of many change projects. The author proposed tools such as gateways, backwards compatible networks, and polyvalent networks to ease these changes.

Chae et al. (2005) studied the role of pre-existing information systems in the development and emergence of a new system. The authors argued that pre-existing information systems are active forces in systems development. Their study built a theoretical framework that included institutional features and integrated components of structuration theory and actor-network theory to provide a better analysis of how information technologies and institutional features interact in the structuring of organisational information systems.

Although the above studies have focused on some of the roles of institutional theory in information infrastructure implementations, other studies have used different approaches in discussing institutional implementation without mentioning institutional theory. Institutional theory has either been mentioned or used in information infrastructure studies that discussed top-down and bottom-up implementation approaches (Brown et al. 2011; Hanseth et al. 2010; Sahay et al. 2009; Vaast et al. 2009). These studies discussed and analysed the major issues in information infrastructure research. Although the institutional theory was not used as a theory in these studies, organisational practices which can be a component of institutional forces have been discussed which make these studies important to highlight. For example, the issue of control and the top-down approach in information infrastructure implementation has implications for the way institutional mechanisms influence implementation. In this regard, Hepso et al. (2009) studied the top-down approach used by NorthOil to institutionalise a Microsoft-based SharePoint e-Infrastructure. The study shows bottom-up strategies also support the distribution of information to the professionals who are doing the work. The project was planned to solve issues related to transparency, information sharing, and integration while avoiding a legacy of unstructured data management within the company. It ran into

difficulties and struggled to duplicate and replace the specialised systems and the patches and compromises that had been added to move data between them. The story of infrastructural change at this project was about resolving a central and complex tension between implicit and explicit top-down demands for tight integration embedded in the SharePoint infrastructure and how these tensions unfolded dynamically against the persistent, bottom-up reliance on niche systems and the micro-practices of commensurability. The NorthOil SharePoint story represents something of a midpoint between very ambitious agendas and accounts of transformational change on one hand, and overly traditionalist accounts of the durability and resilience of local practice on the other.

Another example is the study 'Integration of Health e-Infrastructures' in India by Sahay et al. (2009). The authors argued that information infrastructures typically evolve in an incremental way through partly-planned and unplanned processes and where system integration failures contribute to the lack of evolution of the infrastructure. Rather than emphasising the technical aspects of information infrastructure, the authors focussed on how political and institutional interests are embedded in efforts to achieve integration.

Some studies did not use institutional theory for their case study but have drawn on the components of institutional theory or institutional practices. For example, Constantinides et al. (2014) proposed a polycentric approach to governing infrastructure development. They suggested that governance roles should not be defined during the early stages of information infrastructure development, as this will trigger resistance from users who see it as being imposed from the top down. Rather, they should allow different entities to govern themselves as long as they do not affect other layers. As these entities gradually reach a common understanding of governance, they will be able to move to the next layer. This suggestion is called progressive nesting (Constantinides et al. 2014). The study drew on Suchman (1995) and three types of legitimacy: pragmatic legitimacy, cognitive, and moral or normative legitimacy. The authors argued that legitimacy is a central tenet of institutional theory, although their study did not focus on their interrelationship. The author drew on institutional legitimacies only to develop an understanding of collective action framing in information infrastructure development.

Grisot et al. (2014) used the installed base cultivation approach to study the role of architecture in information infrastructure evolution. The process-oriented approach is one

of the aspects of the cultivation strategy, which requires ongoing and careful step-by-step engagement with technology institutional practices. The study argued that information infrastructure should be developed from the bottom up as users and entities experiment with their needs and progress gradually. This approach places some requirements on infrastructure and the organisation, as they need to be straightforward and flexible. This means that they should be loosely coupled with other infrastructures and development organisations (Grisot et al. 2014). The study did not use institutional theory as a theoretical approach but discussed how process orientation requires step-by-step engagement with technology and institutional practices and can only be developed from the bottom up.

Studies of information infrastructure that applied institutional theory to government projects have generally looked at projects at the national government level. However, searches of the literature found no comprehensive study that looked into the three institutional forces that influence information infrastructure implementations. There are few (if any) studies that focus on how institutional forces influence information infrastructure implementation. It is also important to consider new phenomena such as a centralised IaaS implementation with set standards and how these standards are institutionalised on the users. The next section discusses the how this research will study information infrastructure from the institutional isomorphic mechanism perspective.

3.7. Institutional Forces and Information Infrastructure

Information infrastructure literature shows that the implementation of standards across organisations is problematic, and it is hard to achieve even if the organisations are similar (Ciborra et al. 2000; Hanseth et al. 2007). As new technologies such as cloud computing emerged, central government organisations started to implement them as a solution for many of the implementation challenges they previously faced. The value of institutional theory becomes apparent when looking at central governments that are trying to impose standards through their hierarchal power.

Institutional theory has been used to study information infrastructure from different perspectives (Hanseth et al. 1998; Iannacci 2010; Racherla et al. 2013). However, it is important to explore national information infrastructure implementation by considering

the three forces of institutional theory, the mimetic, normative, and coercive institutional forces. The different government agencies that are implementing new systems as part of the national information infrastructure are driven by either a coercive, normative or mimetic mechanism. While these mechanisms might not solve all the concerns of central standardisation, they are an important starting point for investigations.

As discussed above, the different institutional forces play an important role in understanding IS implementation and the standardisation of IS in government, but their impact becomes more relevant when considering the implementation of centralised, national-level models. Centralised models implemented from the top down are complex in nature, and the implementation process faces such challenges as normative practices; Hence, what might work in one particular context might not work in another. It is important to consider the impact of passive acceptance of the new infrastructure. The top-down approach to information infrastructure implementation requires subordinate organisations such as government agencies to accept it as a fait accompli. This ignores a vast volume of literature demonstrating empirically that the top-down centralisation approach is troublesome. A potentially disruptive technology such as cloud computing can dramatically standardise IaaS, PaaS and SaaS services (for example), leaving any space for modification only at a higher layer and for small, undeveloped systems.

It is important not to overlook the literature that discusses institutional intervention using the framework proposed by King et al. (1994). These authors view institutions as social entities that apply controls and influence the conduct of social agents. They believe that institutions act to motivate innovation and encourage the accessibility of knowledge and expertise. These are essential to the production and availability of innovations (supply-push) and influence potential users to adopt them (demand-pull). The authors recommend institutional intervention through knowledge-building, knowledge deployment, subsidy, mobilisation, standard-setting, and ultimately by innovation directives. Investigating this view of institutional intervention is important to an exploration of G-Cloud implementation.

From the above discussion, it is clear that institutional theory in the form of the three institutional forces plays an important role in understanding the implementation of IS and the consequential standardisation of existing systems. Many studies have addressed IS implementation using institutional theory; however, its application in information

infrastructure is limited. Although researchers such as Monterio et al. (2014) have suggested studying information infrastructure using institutional theory, to the best of our knowledge no comprehensive study has addressed information infrastructure implementation by considering the three institutional forces. The purpose of this study is, therefore, to use the three institutional forces to study information infrastructure in the implementation stage.

3.8. The Organisational Practices of Isomorphic Mechanism

The three isomorphic mechanisms or institutional forces do not occur spontaneously but result from the organisational practices on which they are associated with. The previous section discussed the importance of the institutional forces in explaining the implementation of information infrastructure. This section identifies different organisational practices and associates these practices with the institutional coercive, normative, and mimetic forces. It will show how these forces are identified in the literature by identifying the different organisation practices. Organisational practices are defined as ‘an organisation's routine use of knowledge for conducting a particular function that has evolved over time under the influence of the organisation's history, people, interests, and actions’ (Kostova et al. 2002). Organisational practices show the shared knowledge of an organisation and its members come to learn, accepted, and approve them. (Kostova et al. 2002).

In addition to information management studies, management and organisational studies were reviewed to research the organisational practices that lead to the different institutional forces. These organisational practices can be categorised under three heads: the institutional coercive, normative, and mimetic forces.

The literature shows a number of organisational practices related to the coercive institutional force. These are: top-down, centralised policy, rules and regulations, client requirements, stakeholder power, sanctions/punishments, financial control, policy documents, surveillance, compliance, and imposed organisational structure. The coercive practices are mostly imposed by external organisations, and many of them are initiated by organisations with authority over one or more subordinate organisations. Studies describe these practices as characteristic of a top-down approach or top-down pressure

(Currie 2012). From the public sector perspective, the top-down approach is commonly imposed by national governments (Dobbin 1994; Jensen et al. 2009) or by a foreign government as a condition of an aid package (Guler et al. 2002).

Top-down practices are not limited to a national government or one country's mandate over another, but can also be from a central body or organisation which imposes orders on its agencies. The health sector is an example of how the central body can practise a top-down approach by imposing the implementation of projects (Adler-Milstein et al. 2008; Currie et al. 2011; Jensen et al. 2009). Another example of coercive practice can be manifested by a central government that exercises its stakeholder power and control over its government agencies (Currie 2012; Currie et al. 2007; Grimshaw et al. 2006). This control can take the form of setting standards (Benders et al. 2006) or initiating centralised policies that the local government agencies are mandated to follow (Brown et al. 2011; Currie 2012; Gozman et al. 2014). Policies, stakeholder power, and rules and regulations may not be acted on; hence, sanctions or punishment can be another characteristic of the coercive force (Gozman et al. 2014). For example, the US Dodd-Frank Act established a bounty for people who report violations to the regulator by allowing those people to receive a percentage of the fine imposed. This bounty can be of considerable value. In 2012, Goldman Sachs was fined $22 million for sharing non-public information with its traders (Gozman et al. 2014). The bounty incentivised employees and partner organisations to report wrongdoings. Another coercive practice comes from the power of an organisation over financial resources (Nicolaou 1999; Tsai et al. 2013). For example, if an organisation elects to make a significant investment in a new information system to support the interchange of order and invoicing data, its close trading partners may be coerced into making a similar investment in the same system to maintain system homogeneity and trading relations (Nicolaou 1999).

Another form of organisational practices related to coercive mechanism comes through different forms of governance. For example, strategic plans for IT in healthcare and the EPR systems act as institutional forces leading to more isomorphism among hospitals and wards within hospitals (Jensen et al. 2009). The strategic IT plan comes with policy documents that enforce implementation of the plan by the users (Currie 2012). Another form of organisational practice comes from surveillance. For example, financial watchdog organisations encouraged responsible trading in the period after the 2007–2009 financial crisis through surveillance, monitoring, and the automation of regulatory rules

(Gozman et al. 2014). Coercive pressure was applied to organisations that impeded implementation of the IS applications designed for this purpose but which conflicted with the existing organisational structure (Soh et al. 2004).

Organisational practices likewise lead to normative behaviour or force in organisations. This behaviour has been studied by many scholars as one of the three institutional forces that influence change in organisations. One of the visible practices noted by many scholars is the role of professionals in achieving isomorphism (Benders et al. 2006; Currie 2012; Currie et al. 2007; Gosain 2004; Kshetri 2007). This is evident in industries such as health (Currie 2012; Currie et al. 2007) or finance organisations (Gosain 2004). The professionals in these organisations can be any person or group that has cognitive knowledge in certain things. For example, in the case of a Dutch publishing company, the professionals were the IT staff who created change through the implementation of ERP (Benders et al. 2006).

The role of professionals can also lead to failures in achieving organisational change (Currie 2012). For example, Currie (2012) shows how the NHS National Care Records Service project (NCRS) failed to achieve legitimacy among a large part of the medical profession, which resulted in its failure to diffuse across the patient community. The failure occurred because the policymakers excluded patients from NCRS decision-making process. This was escalated by clinicians' concerns about patient data security and the privacy of the system. Currie et al. (2007) added that clinicians, as a professional group in the NHS programme for IT, had developed normative frameworks that underpinned their cultural-cognitive beliefs and the values and ideas that governed the conduct of healthcare practice. The clinicians' relied on their professional knowledge, expertise and judgement to consult an essentially passive patient about treatment options without relying on IT systems.

The normative behaviour of professionals arises because of their backgrounds, education, certifications, and training of those professionals led them to have similar behaviours in either accepting or rejecting change (Butler 2003), and they can have either scientific or technical expertise (Guler et al. 2002). Experience in a particular area also leads to normative behaviours (Currie 2012). This experience can lead professionals to see routine as an important normative practice that is not amenable to top-down policy changes that

bring about abrupt institutional change, as in the case of the NHS IS implementation (Currie 2012).

The role of professional associations has been identified by many studies as a vehicle for the definition and endorsement of normative rules about organisational and professional behaviour (Kshetri 2007; Swan et al. 1999; Townley 1997). For example, Kshetri (2007) explored the institutional factors affecting the business process and IT outsourcing. The study identified the elements of normative institutions in trade and professional associations, such as (Ex, NASSCOM [The National Association of Software and Services Companies, a lobby for the software and services industry], and the Organisation for the Rights of American Workers), that can use social obligation as a tool to induce certain behaviours in the outsourcing industry. These professional association also include unions who apply pressure against offshore companies on in the destination country (Kshetri 2007).

Other scholars have discussed different organisational practices that relate to normative behaviour in studies which do not directly discuss the isomorphic mechanisms. An example of this is the influence of professional associations in the diffusion and design of Computer-Aided Production Management (CAPM) technologies in UK and Sweden.

Organisational practices also lead to the mimetic institutional force. This occurs when uncertainty encourages organisations to adopt a strategy of imitating other organisations (Gosain 2004). For example, off-the-shelf enterprise systems generate a high level of uncertainty. This creates difficulties in using conventional quantitative metrics such as cost savings, and organisations frequently use qualitative criteria such as cross-functional integration to justify their actions (Gosain 2004). This uncertainty leads the organisation to look for a role model by creating a mimetic culture (Fligstein 1985; Nicolaou 1999). A mimetic culture forces organisation to conform structurally to the cultural expectations of competitors, suppliers, or the state (Fligstein 1985). In the case of many IS implementations, a mimetic culture comes from following a champion who is perceived to be an expert in the field (Nicolaou 1999). American Airline's SABRE reservations system is an example of this. The system was developed as the result of a leadership initiative that opposed the existing system for airline reservations. Other airlines then followed this model and implemented the SABRE system (Nicolaou 1999).

The mimetic force can also be seen by countries adopting the cultural model of another country (Kshetri 2007). For example, other countries have adopted the model of IT offshoring used by US companies (Kshetri 2007), and the culture model of western organisations has been transferred to Japan (Guler et al. 2002). This mimetic behaviour is not only applied at the level of countries but also by organisation looking for best practices to implement new projects (Currie 2012; Davidson et al. 2007; Fountain 2004; Gosain 2004). Benders et al. (2006) discuss the way organisations have installed ERP systems after other similar organisations have successfully implemented them. Best-practice is also associated with taken-for-granted behaviours which reflect unconscious or blind adherence to preconscious rules or values (Kshetri 2007; Oliver 1991).

Another example of an organisational practice that leads to mimetic behaviour was identified by Daniels et al. (2002) as the manager mental model. The authors explain that managers simplify their competitive environment by focusing on a subset of competing firms within an industry and hence consider their closest competitor as a model.

Along with the above organisational practices, this study views institutional forces as a means to change and implement standards. Previous studies and frameworks have addressed institutional forces and change. Among these, the framework developed by Currie (2012) showed how organisational fields that are homogeneous in structure, process, and behaviour experience pressure for greater heterogeneity in the form of institutional change. The framework showed that the isomorphic change, whether through the coercive, mimetic, or normative institutional forces, can be used to investigate institutional change in the organisational field of healthcare. Currie (2012) study built on previous research which suggests that new institutional logics that emerge from coercive, mimetic and normative forces are likely to come into conflict with the existing institutional logics. This conflict results in a scenario where an innovative system or process may fail to become institutionalised regardless of its potential to change working practices (Currie 2004; Currie et al. 2007; Swanson et al. 1997). Currie's framework allows this research to examine the successful implementation and standardisation of Oman's National G-Cloud Programme. The implementation will be successful if the government agencies' e-portals are launched, are available to the users and have achieved standardisation within the expected timeframe.

Figure 3.1 summarises the different organisational practices by categorising them according to the three institutional forces.

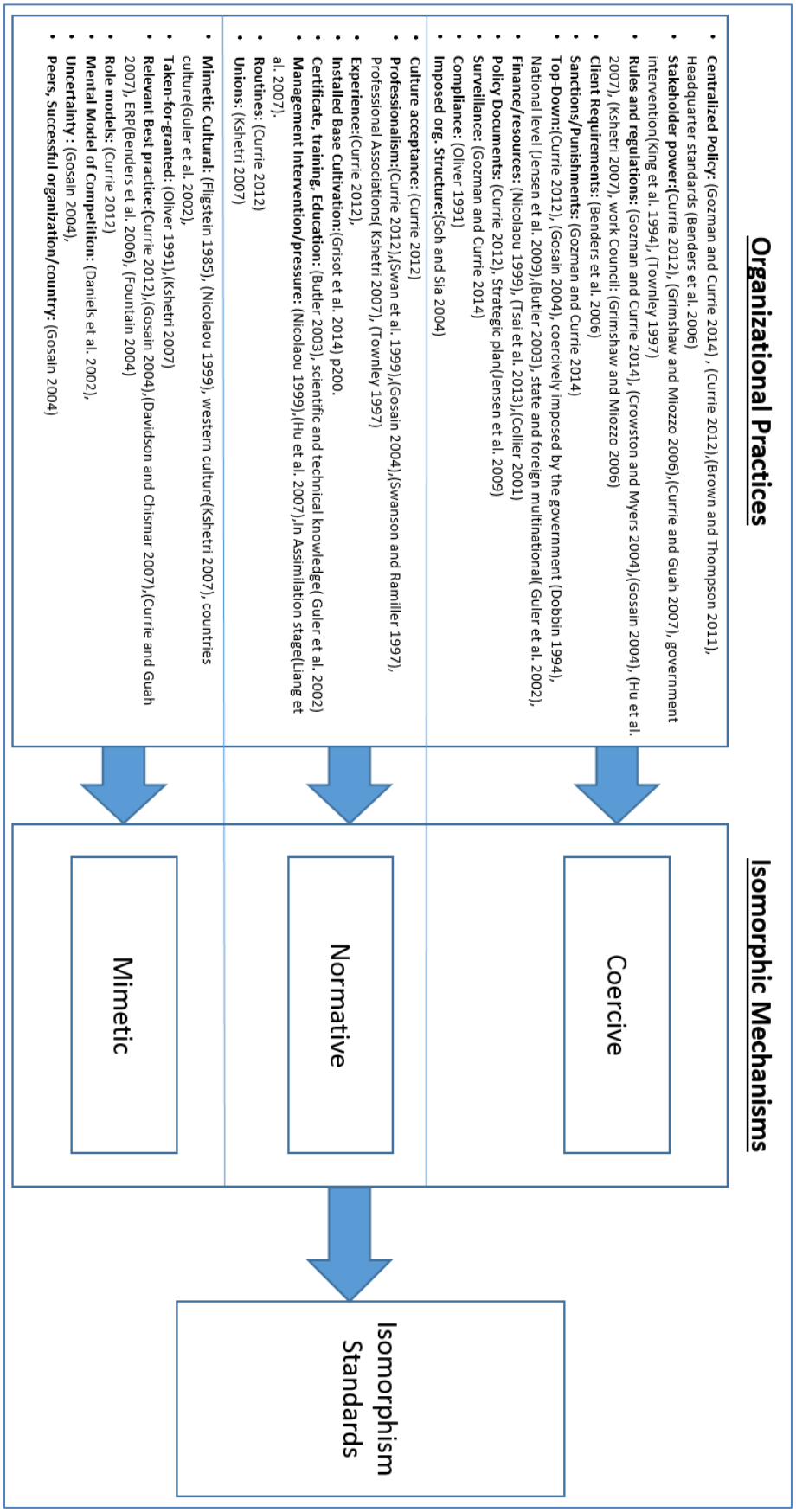

Figure 3-1: Organisational Practices which lead to Isomorphic Mechanisms Standards – Source: (Currie 2012)

3.9. Limitations of Institutionalism

Although institutional theory makes valuable contributions in social science studies (including the information systems field), like other theories, it has its limitations. These limitations vary from general limitations to institutional theory to its limitations in IS studies. It has been claimed that one of the main limitations of institutional theory is that it lacks an understanding of agency (DiMaggio 1988). The lack of agency argument was in response to the earlier argument that all organisation become isomorphic and thus become similar over time (DiMaggio et al. 1983). DiMaggio et al. (1983) argue against the idea of that organisations are a prisoner of their institutional environment by suggesting that researchers should add agency and consider the 'often creative ways in which organisations inculcate and reflect their institutional environments'(Suddaby 2010). This concept is identified as institutional entrepreneurship.

This argument has prompted many scholars, including Oliver (1991), to publish papers related to this limitation and journals to publish special issues related to institutional change and institutional entrepreneurship. Suddaby (2010) observed that management journals are full of empirical examinations of institutional agency and suggested that 'institutional theory presents organisations as hyper-muscular supermen, single-handed in their efforts to resist institutional pressure, transform organisational fields and alter institutional logics' (Suddaby 2010).

Some scholars have suggested that the approach adopted by researchers to address institutional theory has developed some limitations. As described earlier, institutional theory became a dominating perspective in macro organisation theory (Greenwood et al. 2008). The dominant perspective of institutional theory offered a good argument to criticise the work of Pfeffer (1993) who favoured a single paradigm. Pfeffer (1993) argued that a single paradigm offers many benefits, including improved professional status, higher access to resources, the simplicity of collaboration and better productivity. However, Suddaby (2010) argued that are some challenges associated the macro theory of institutionalism. He proposed that theories are a tool, and every theory contains within its implicit goals and assumptions that define its parameters and application. He argued that many researchers who use other theories to address different problems are unwilling to drop their tools. Instead, they modify the core puzzles of institutional theory and often their empirical interpretation to suit their prior works, their methodologies, and their

perspectives. These modifications cause institutional theory to lose focus and consistency as it becomes infused with the agendas and priorities of distant paradigms (Suddaby 2010).

IS studies have also acknowledged the limitations of institutional theory as it relates to IS research. Most IS studies have noted the limitations of institutional theory as per previous research in intuitional theory. Gosain (2004), for example, has written that over time, technical adaptations made by organisations may give rise to institutional pressures and alter institutional norms and definitions of legitimacy. Currie (2009) cautioned the researcher while using the institutional to avoid the dual problem of either presenting concepts vaguely or over-simplify it to help explain social phenomena. The author highlighted that the neo-institutional theory adds challenges to IS as it a single theory and done not provide conceptual clarity. Also, 'institutional theory offers a lens to examine the relationships between constructs is further complicated in studies that use either variance or process methods as the theoretical and methodological preferences of IS researchers influence the choice of environmental and organisational variables used in a research design' (Currie 2009, p. 66). Researchers, therefore, need to avoid becoming 'thrown into a field of research that has almost no limits, and also few directions about what is more or less important or relevant [. . .] [where] almost all aspects of social life become a possible research object' (Hasselblad and Kallinikos, 2000, p. 702).

3.10. Conclusions

The previous chapter reviewed the literature to find the gaps of institutional isomorphic mechanisms in the area of information infrastructure. This chapter reviewed institutional theory in general and explored the importance of institutional isomorphic mechanisms in institutional theory. The literature asserts the importance of using institutional theory in information infrastructure studies since there is a dearth of studies that explore the role of institutional isomorphic mechanisms or the institutional forces at play in the implementation of information infrastructure.

This chapter started by justifying the use of institutional theory for this research. It then explained institutional theory and how it is used in organisations and identified the three isomorphic mechanisms in institutional theory. The use of institutional theory and the

institutional forces in government were explored. Later, it explored infrastructure information studies that used institutional theory and how they did not use the three institutional forces to explain implementation complexities. The next section explained the relationship between institutional forces and standardisation and explained how this study will use the institutional forces to investigate the implementation of information infrastructure in government. This investigation was conducted by identifying the different organisational practices that lead to one of the institutional forces. Finally, the limitations of institutional theory were discussed.

The study proposes a framework, figure 3.1, to interpret and analyse the case study. The framework shows the different organisational practices that have been highlighted by researchers and which are associated with each of the institutional coercive, mimetic, and normative forces. Identifying these practices will help to analyse the case study of this research.

4. Chapter Four: Methodology

4.1. Introduction

The previous chapters provided a detailed literature review and discussion of the adopted theoretical lens. This chapter discusses the research methodology used to conduct this research.

Myers et al. (2002) define research methods as the means for acquiring and building knowledge within a discipline. Research is a process that transfers philosophical assumptions to study design and data collection. Data collection using different research methods requires different skills, expectations, and research practices. For the research method to be accepted in a particular area of knowledge, it needs to be relevant, precise, and justifiable within that field of knowledge (Harvey et al. 1995).

Having explored the context of the research (cloud computing and information infrastructure) and the theoretical perspective to explore it (institutionalism), this chapter aims to provide details of how the research was carried out in the field. The research adopted a qualitative interpretive approach that allows for in-depth exploration of the phenomena (Myers 2010). It used the case study approach as being best suited to answer the research questions.

The first three sections of this chapter describe the research philosophies and paradigms in general and then explain the rationale for selecting a qualitative interpretive approach and the use of the theory. The next section explores the different research strategies, explains the rationale for selecting the case study method, and describes the case study background. The data collection method is then presented, explaining how the data was collected from different data sources. The last section describes the methods and techniques used, how the data was analysed, and the approaches used to organise and interpret the data. Finally, a conclusion that summarises all sections of this chapter is provided. Figure 4.1 illustrates the layout of this chapter, showing the different philosophical paradigms, the research design, research strategies, different case designs, and the selected research methodology.

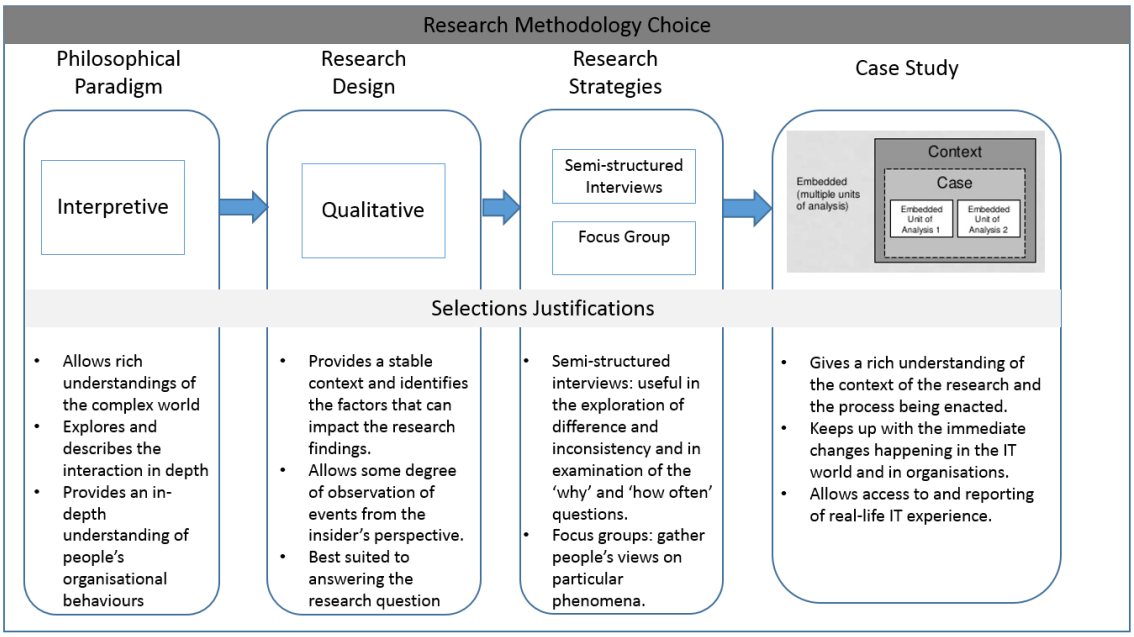

Figure 4-1: Overview of the selected research methodology

4.2. Use of Theory

The objective of using theory in the early stages of interpretive cases studies is to create an initial theoretical framework which takes account of prior knowledge and constructs a rational theoretical basis to inform the topics and approach of the early empirical work (Walsham 1995). Voss et al. (2002) added that case research starts with a research framework that graphically underlies the research and provides a prior view of the general constructs or categories intended for study and their relationships. Saunders et al. (2007) noted that a conceptual framework enables the researcher to link the study to the existing body of knowledge in a subject area not studied well. The conceptual framework functions as a sensitising device helping the researcher to theorise or make logical sense of the research problem (Sekaran 2006). IS theories can be classified by the degree and way they address the goal of the theory (Gregor 2006). Theories in general show as mental entities that aim to describe, explain, and improve understandings of the world and, in some cases, to offer predictions of what will occur in the future and give a reason for intervention and action (Gregor 2006). Other scholars such as Miles et al. (1994) have stated that a using a conceptual framework lays out the key constructs related to the phenomenon being studied and the anticipated relationships between them. Thus, using an initial framework serves as a guide for the exploration and presentation of possible explanations for the phenomenon of information

infrastructure implementation in government. This study uses institutional theory to address information infrastructure implementation. It considers the role institutional forces play in the standardisation of information infrastructure.

4.3. Research Paradigm

The term ‘paradigm’ is regularly used in the social sciences. A research paradigm or philosophy informs how people study their world. It is the way humans look at the world, interpret it, and choose which of the things seen by the researcher are usable and necessary to document. The research paradigm suggests how research is conducted, by whom, and with what degree of involvement or detachment (Rubin et al. 2011). Saunders et al. (2007) defined a paradigm as ‘a way of examining the social phenomena from which particular understanding of these phenomena can be gained and explanations attempted’. Oates (2005) suggested that a paradigm is a set of standard assumptions for thinking about some of the aspects of the world. Myers (2013) stressed the fact that every research study is based on assumptions, and these are the views of the researcher about the nature of the world and the knowledge that can be obtained. These assumptions and the proper research methods can be either quantitative or qualitative in nature.

It is important to consider the definition of research philosophy and research paradigms before explaining the view and positioning of this research. Saunders et al. (2007) suggested three different ways of looking for a research philosophy to enhance understandings of the way a researcher approaches a study of a particular field. These means are epistemology, ontology, and axiology. Epistemology concerns what constitutes adequate knowledge in the field of study (Hirschheim 1985). Hirschheim (1985) argues that the most applicable philosophical assumptions are those that are related to the epistemology that guides the research. Ontology is concerned with the nature of reality, what assumptions the researchers have about how the world operates, and the commitment held to a particular view (Saunders et al. 2007). Two aspects of ontology are essential to the researcher: objectivism and subjectivism. Objectivism describes the position that social entities exist in a reality that is external to social actors. Subjectivism holds that social phenomena are formed from the views and the actions of those social actors concern with their existence (Saunders et al. 2007). Saunders et al. (2007) argue that management theories and practices lean toward treating organisation culture as a

variable to produce the sort of state desired by the manager. Subjectivism, however, rejects this and considers it too simple. It argues that culture is something that is created and recreated through the complex collection of phenomena that include social interaction and physical factors (Saunders et al. 2007). Table 4.1 shows the beliefs underlying the different approaches to conducting research.

Table 4-1: Beliefs underlying the conduct of research

Beliefs about:	Explanation:
Physical and Social Reality	
• Ontology	Whether social and physical worlds are objective and exist independently of humans, or subjective and exist only through human action
• Human Rationality	The intentionality ascribed to human action
• Social Relations	Whether social relations are intrinsically stable and orderly, or essentially dynamic and conflictive
Knowledge	
• Epistemology	Criteria for constructing and evaluating knowledge
• Methodology	Which research methods are appropriate for generating valid evidence
The Relationship between Theory and Practice	The purpose of knowledge in practice

Source: (Orlikowski et al. 1991)

While there are different means of research philosophy, there are also various types of research. Types of research vary from descriptive, exploratory, analytical, predictive, qualitative, quantitative, deductive, inductive, applied, and basic research (Husse et al. 1997). The selection of the research type depends on the justification the researcher provides for the method or the methodology to be used for the study.

This section explains the three research paradigms most used by researchers. Research epistemologies can be classified into three perspectives: positivist, interpretive and critical studies (Chua 1986; Klein et al. 1999; Neuman 2006; Oates 2005). The interpretive approach is adopted for this research, and the justification for the selection of an applicable research method is given below. The justification for choosing the case

study method along with its characteristics and limitations is also given below. Finally, the options for data collection are examined and selected. The next section describes the three research paradigms.

4.3.1. The Positivist Paradigm

This is one of the oldest research paradigms and the most dominant form used in business and management disciplines (Myers 2013; Oates 2005) and is referred to as the scientific approach. Bryman (2012) defines positivism as 'an epistemological position that advocates the application of the methods of the natural sciences to the study of social reality and beyond'. The key feature of positivism is that the world is ordered and considered objectively. Positivists believe that as reality is objective; it can be explained by quantifiable properties that are independent of the researcher and his tools. A positivist attempts to test the theory in order to increase the predictive understanding of the phenomena. Positivism has been labelled as the natural-science model for social research (Myers 2013). Natural science as a research method and tool is seen proper for studying social and organisational phenomena (Myers 2013). The idea behind the positivist research is a structured methodology in order facilitate quantifiable observation that leads to statistical analysis (Gill et al. 2010).

Studies can be classified as positivist in general and in IS if there is 'evidence of formal propositions, quantifiable measures of variables, hypotheses testing, and the drawing of inferences about a phenomenon from the sample to a stated population (Orlikowski et al. 1991). The positivist paradigm had been criticised for its limits when dealing with people and capturing their beliefs and is considered too subjective (Bryman 2012).

4.3.2. The Critical Paradigm

Critical studies aim to critique the existing situation through exposing what is believed to be deeply rooted in social systems and therefore to transform these restrictive social conditions (Orlikowski et al. 1991). Myers and Avison (2002) described the critical paradigm. They proposed that it assumes that social reality is historically established and that it is shaped and reshaped by people. It recognises that people's ability to consciously

act to change their social and economic circumstances is constrained by various forms of social, cultural, and political domination. The primary objective of critical research is seen as being one of social critique, whereby the restrictive and alienating conditions of the status quo are brought to light. Critical research focuses on the oppositions, conflicts and contradictions in contemporary society and seeks to be emancipatory, that is. it should help to eliminate the causes of alienation and domination (Myers et al. 2002). Studies that match the critical approach were 'evidence of a critical stance towards taken-for-granted assumptions about organisations and information systems, and a dialectical analysis which attempted to reveal the historical, ideological, and contradictory nature of existing social practices' (Orlikowski et al. 1991).

Myers et al. (2011) wrote that critical research has not yet been recognised as a legitimate approach in IS disciplines. The authors proposed a set of principles for conducting critical field research in IS to raise awareness of its potential and increase its legitimacy. They believe that these principles will encourage further reflection and debate on the important subject of grounding critical research methodology. Cecez-Kecmanovic (2011) identified and described key distinguishing dimensions of critical research methodology and illustrated their relevance and implications for critical IS research.

While this research aims to offer insights leading to alternative views of cloud computing and information infrastructure, it cannot be fully classified as critical. This would require following or adopting a critical theory, and in this research view, institutionalism is not there yet. Suddaby (2015) explained that institutional theory was once critical, but the transition from the old to the new institutionalism has eroded the capacity to be critical. Given the complexity of the phenomenon to be studied, this research elected to adopt the research elected to adopt the better-tested paradigm.

4.3.3. Interpretive paradigm

When looking at the social world of business and management, it evident that it is far too complex to offer itself to theorising by specific rules in the same way as the physical sciences. Rich understandings of the complex world would not be possible if its complexity were reduced to series of rule-like generalisations. The interpretive paradigm may answer the need for such rich understanding. Neuman (2006) states that

interpretivism is the second major philosophical paradigm, as it aims to understand and interpret how people create and sustain their social world. Interpretive researchers assume that access to reality is through social constructions such as language, consciousness, and shared meaning (Myers et al. 2002).

The objective of the interpretive approach is not to test a hypothesis; it is rather to explore and describe the interaction between the different independent social factors (Rubin et al. 2011). Braa et al. (1999) explained that interpretive research is concerned with obtaining consequential information from social interactions. This approach is concerned with understanding the social context of an information system, the social processes used to develop and construct it, and the people who influence it and are influenced by it in a social setting (Oates 2005).

The interpretive paradigm assumes that people create and interpret their own independent and inter-independent meanings as they interact with the world around them (Orlikowski et al. 1991). It advocates that the researchers should understand differences between humans in their roles as social actors (Saunders et al. 2007). In studies that match the interpretive approach, researchers are committed to understanding a phenomenon within its social contextual condition, where the phenomena of concern is studied in its natural setting and from the viewpoint of the participant, and where the researchers do not force their outsiders' a priori understanding of the conditions (Orlikowski et al. 1991).

There are no pre-set dependent or independent variables in interpretive research (Kaplan et al. 2005). The aim is to make sense of the complexity of human knowledge in different circumstances and explain how people give meaning to them (Kaplan et al. 2005). In IS research, the aim of the interpretive method is to understand the context of IS and the processes that influence it and are affected by it (Klein et al. 1999).

Klein et al. (1999) proposed a set of seven principles to help to conduct and evaluate interpretive field research in IS and understand its philosophical rationale. These principles are shown in Table 4.2 below. They are derived primarily from anthropology, phenomenology, and hermeneutics (Klein et al. 1999).

Table 4-2: The principles for conducting interpretive field studies

1. The Fundamental Principle of the Hermeneutic Circle

This principle suggests that all human understanding is achieved by iterating between considering the interdependent meaning of parts and the whole that they form. This principle of human knowledge is fundamental to all the other principles.

- Going back and forth between data collection and data analysis, and between analysis and conclusion which allow the researcher to revise the data constantly.

2. The Principle of Contextualisation

Requires critical reflection on the social and historical background of the research setting, so that the intended audience can see how the current situation under investigation emerged.

- looked at the historical context of every organisation and tried to understand the internal culture and dynamic of the organisation and how they are related to the centre which is trying to impose the Government Cloud on them

3. The Principle of Interaction Between the Researchers and the Subjects

Requires critical reflection on how the research materials (or 'data') are socially constructed through interaction between the researchers and participants.

- The researcher collected the data by himself, which was through semi-structured interviews.

4. The Principle of Abstraction and Generalisation

Requires relating the idiographic details revealed by the data interpretation through the application of principles 1 and 2 to theoretical, general concepts that describe the nature of human understanding and social action**.**

- Used a case study approach which does not generalise, however, the generalisation was on theory.

5. The Principle of Dialogical Reasoning

Requires sensitivity to possible contradictions between the theoretical preconceptions guiding the research design and actual findings ('the story that the data tell') with subsequent cycles of revision.

6. The Principle of Multiple Interpretations

Requires sensitivity to possible differences in interpretations among the participants as typically expressed in multiple narratives or stories of the same sequence of events under study. Similar to various witness accounts even if all tell it as they saw it.

- Looked at multiple interpretations of the data which was the reason for looking at the different theoretical approach.

7. The Principle of Suspicion

Requires sensitivity to possible biases and systematic distortions in the narratives collected from the participants.

Source: (Klein et al. 1999)

The above set of principles encourages researchers to consider each principle and ensure that none have been arbitrarily left out (Kanellis et al. 2009). Walsham (1995) proposed a set of non-prescriptive instructions for interpretive fieldwork. The author focused on how to choose a style of working in the field. These styles are: gaining and maintaining access, collecting field data, working in different countries, analysing data, and constructing and justifying a contribution.

Walsham focused on ethical research issues such as confidentiality and anonymity and advocated the view that interpretive research is here to stay in the field of IS(Walsham 1995). This research considered these instructions while conducting the empirical investigation. For example, access to the interviewees was arranged through middle managers to assure that they could provide the data with comfort. Confidentiality and anonymity were assured by explaining this to the interviewees at the start of the interviews.

Orlikowski et al. (1991) examined various research perspectives and suggested philosophical perspectives that may be useful in assisting the researchers to study the phenomena that engage IS researchers. These drew from Chua's (1986) classification of the assumptions constituting the philosophical positions that researchers adopt towards the world and their work. Chua’s three categories may offer powerful insights for studies of IS phenomena.

Belief in physical and social reality

From the interpretive point of view, this emphasises the importance of subjective meanings and social-political and symbolic action in the process where human continually construct and reconstruct their reality (Orlikowski et al. 1991). It attempts to understand why an individual's socialisation, interaction, and participation in social life will give it a certain understanding and meaning. Ontologically interpretive IS research assumes that the social world is produced and reinforced by humans through their action and interaction. This is unlike the positivist view where researchers are presumed to discover social reality (Orlikowski et al. 1991).

Beliefs about knowledge

Beliefs about knowledge hold that the language humans use to describe social practices constitutes those practices. Therefore, 'understanding social reality requires understanding how practices and meanings are formed and informed by the language and tacit norms shared by humans working towards some shared goal' (Orlikowski et al. 1991).

Beliefs about the relationship between theory and practice

The interpretive research approach to the relationship between theory and practice is that the researcher can never assume a value-neutral position, and is always implicated in the phenomena being studied. Researchers' prior assumptions, beliefs, values, and interests always intervene to shape their investigations (Orlikowski et al. 1991).

Oates (2005) identified several characteristics of interpretative research. These were: multiple subjective realities, dynamic socially constructed meaning, researchers' reflexivity, and study of people in their natural settings and various interpretations. Lincoln (1985) provided elements that can be used to evaluate the quality of interpretive research: trustworthiness, conformability, dependability, credibility, and transferability.

The current research followed the principles shown in Table 4.2. Klein et al. (1999) stressed that not all proposed principles should be applied to a study provided that they are not left out arbitrarily, and the researcher should be aware of which principles are best applied. The first principle is the hermeneutic circle, where the researcher moves back and forth between different interpretations to uncover part of the phenomena. The researcher also moves back and forth between data collection and data analysis, and between analysis and conclusion. This allows the researcher to revise the data constantly. This iterative process was used for this research. For example, in the case

study for this research, feedback about security standards imposed on government agencies was not clear until a fuller picture emerged by gathering together all the ideas about it.

The second principle, historical contextualisation, was followed. The programme studied came from the historical background of previous government implementations, as discussed above. This allowed the researcher to understand and interpret the G-Cloud programme in a historical context. The researcher also looked at the historical context of every organisation involved and tried to understand their internal cultures and dynamics and how they are related to the centre, which was trying to impose the Government Cloud on them. The researcher has also explained the ITA's background of implementing large projects in government agencies.

On the principle of interaction between the researcher and the subject, the researcher collected the data personally through semi-structured interviews. The researcher talked to the people and held focus groups in which some of the interviewees were not previously known to the researcher. The researcher made sure that all the interviewees were informed well in advance and that interviews were held at a time convenient to them, in a comfortable place either within or outside the organisation.

The fourth principle is the principle of abstraction and generalisation. The researcher used a case study approach that does not generalise; however, the generalisation was on theory. The fifth principle followed was the principle of dialogical reasoning; the researcher was very transparent about the data and the historical, intellectual basis.

Following the sixth principle, that of multiple interpretations, the researcher was sensitive to different theoretical approaches that could be used to explore multiple interpretations of the data. In this way, the researcher found that the three forces emerged strongly from the data, but that the normative forces were not as strong as the coercive and mimetic forces. The seventh principle is the principle of suspicion. The researcher used the concept of triangulation to validate responses by comparing interviews and documents with other interviews and documents.

4.3.4. The Rationale for Choosing the Interpretive Approach

This research objective is to investigate how institutional forces or institutional isomorphic mechanisms lead to the standardisation of information infrastructure in the implementation stage. It investigates the case study of the National G-Cloud Programme in Oman. The interpretive approach is the best fit for this study. The primary rationale for choosing the interpretive approach is that it suits this study's research question. The interpretive approach aims to understand the phenomena proposed to be studied in the sense that people attribute to it (Lincoln et al. 1994).

The research will use the interpretive approach from a theoretical perspective. The interpretive paradigm allows researchers to gain an in-depth understanding of the subject under study by discovering the subjective meanings that participants assign to it (Orlikowski et al. 1991), allowing the research to achieve a broad understanding of the topic. The research explores the interviewee's understanding of G-Cloud implementation in their organisation; this approach will allow them to articulate the practices that led to its standardisation from their points of view.

Klein et al. (1999) explained that our knowledge of reality is gained through social constructions such as language, shared meaning, documents, tools, and other artefacts. The interpretive approach allows the researcher to better understand how standardisation in the implementation of the G-Cloud can be achieved through the isomorphic mechanisms. Walsham (1993) considered that the objective of the interpretive approach in IS is to produce an understanding of the context of IS and be influenced by that context. The interpretive approach provides a wider scope for the researcher to explore various organisational practices from the viewpoint of various stakeholders.

Choosing an interpretive approach to understand cloud computing in the context of Oman is the best fit to answer the research question. As this study is more interested in understanding the meaning and perception of the people than looking at variables, this approach suits the research questions that deal with 'how' and 'what.'

4.4. Research Philosophy

The two traditional approaches available in the social sciences are quantitative research and qualitative research. An alternative is a mixed method that combines these two approaches. The mixed method has been used by many researchers in their work. Table 4.3 gives a brief explanation of the different approaches.

Table 4-3: Main differences between quantitative and qualitative research

	Quantitative	**Qualitative**
Role of theory about research	Deductive: testing of theory	Inductive: Generation of theory
Epistemological orientation	Positivism	Interpretivism
Ontological orientation	Objectivism	Constructionism

Source: (Bryman et al. 2007)

4.4.1. Quantitative Research

The quantitative research approach is a way of testing objective theories by examining the relationship between variables. These variables can be tested on objects so that numbered data can be analysed using statistical measures (Creswell 2013). This approach was developed to study natural phenomena in the social sciences. It emphasises numbers that represent values and levels of theoretical constructs and concepts that can be viewed as reliable scientific evidence (Creswell 2013). The main distinction of quantitative research is that uses measures (Bryman et al. 2007). According to Myers et al. (2002), the most common quantitative methods are survey methods, laboratory experiments, and numerical methods such as mathematical modelling. With an epistemological foundation, the quantitative method is considered to be positivist (Bryman 1984; Bryman et al. 2007; Northcutt et al. 2004). (See Table 4.3.)

The survey method is the most commonly used quantitative method in research and is the most used in business and management research (Creswell 2013). This method can capture a large amount of data from sizeable populations and assess these data with little cost. One quantitative method uses assessments done through pre-set written questions with written or verbal responses (Creswell 2013). The other quantitative method is the

experiment method. This allows the researcher to take control of the independent variables and the participants (Creswell 2013).

The objective of the quantitative method is to divide phenomena into manageable, well-defined pieces or variables. Quantification is useful for splitting phenomena into different and workable elements in a clear conceptual framework. The limitation of quantification is that it does not always support understanding of complex, dynamic, and multi-dimensional wholes (Creswell 2013). In general, quantitative research can be constructed as a research strategy that emphasises quantification in the collection and analysis of data that entail a deductive approach to the relationship between theory and research (Bryman et al. 2007). It embodies a view of social reality as an external and objective reality (Bryman 2003).

4.4.2. Qualitative Research

The qualitative research method allows social science researchers to study social and cultural phenomena (Creswell 2013; Myers 2013; Neuman 2006). It allows researchers to understand people and what they say and do. It also allows the researcher to see and understand the context within which the decision and action take place and helps to explain why someone acted as he or she did (Myers 2013). Qualitative researchers examine things in their natural environment to make sense of or understand phenomena in the context of the meanings people bring to them (Denzin and Lincoln, 2011). The data sources for such research include observations, interviews, documents, and audio-visual materials (Creswell 2013). Some of the standard methods of studying the qualitative approach are action research, grounded theory, ethnography, and case study research. These methods are explained in research strategy section.

Qualitative research can be constructed as a research strategy that uses words rather than quantification in the collection and analysis of data (Bryman et al. 2007). It uses an inductive approach to the relationship between theory and research, where the emphasis is placed on the generation of theories and views of social reality as the consistently shifting emergent properties of individuals' creation (Bryman et al. 2007). The qualitative method does not use measures, and its epistemological foundation is interpretive (Bryman 1984; Bryman et al. 2007; Northcutt et al. 2004; Saunders et al. 2007).

Qualitative research in IS initially attracted few researchers. Until the mid-1990s, many IS journals in North America and Asia saw research in IS as purely quantitative (Sarker et al. 2013). IS researchers had negatively and imperialistically dismissed all qualitative research as being unscientific (Lee et al. 1997). Researchers in the qualitative stream started by using the case study method. Among these were Benbasat et al. (1987), Lee (1989), and Yin (2014).

4.4.3. Mixed Methods Research

The mixed research method combines both qualitative and quantitative researchers in a single project (Bryman 2012). It combines and mixes the philosophical assumptions of both methods. This approach has gain popularity, as it applies the strength of both qualitative and quantitative methods. The complex issues addressed by social and health science researchers could not be addressed adequately by using one method alone (Creswell 2013).

The choice of either quantitative and qualitative research depends on the research objective, and many researchers believe that the results are most useful when the two methods are combined (Miles et al. 1994). However, there are arguments against combining the qualitative and quantitative methods. The first argument is that the research method is rooted in epistemological and ontological commitments, or in a particular version of the world or knowing that world (Bryman 2012). The second argument views qualitative and qualitative research as paradigms, whereas in mixed method research, the epistemological assumptions, values, and methods are inseparably tangled and are incompatible with paradigms (Morgan 1998).

There is a dearth of mixed method research in the IS field, although the current state of methodological variety in the area is encouraging (Venkatesh et al. 2013). There is little research dedicated to building the common scientific foundation needed to improve and sustain the traditional of methodical variety in the IS research and to create a growing body of knowledge (Lee et al. 2009; Weber 2004).

4.4.4. The Rationale for Adopting Qualitative Approach

To answer the research question, this study recognises the need for an in-depth understanding of people's organisational behaviours. Looking at how institutional forces can achieve standardisation in cloud computing implementation requires this study to be qualitative. A qualitative study will allow the researcher to observe and gain some understanding of events from the perspective of the insider. This method gives a good sense of context, identifies the important factors that can impact the research findings, and places emphasis on the processes that occur over time (Bryman 2012).

Different authors have recognised several main features when adopting a qualitative approach. Bryman (2003) recognised two different characteristics of qualitative research. First, it provides a stable context and finds which factors can impact the research findings. Second, it allows the researchers to observe events from the viewpoint of the insiders.

There are many reasons to justify using the qualitative approach for this research. The research objective aims for a better understanding of information infrastructure implementation using institutional theory. Qualitative data has the ability to provide a comprehensive and rich description that enables a better understanding of multiple perspectives (Hoepfl 1997). Qualitative data describes the phenomena not only from the researcher's perspective but also from the reader's perspective. As Lincoln (1985) explains: 'If you want people to understand better than they otherwise might, provide them information in the form in which they usually experience it'.

The qualitative approach is best suited to answer the research question about how the institutional force influence standardisation. Conversely, the positivist paradigm has been criticised for not adequately with people and capturing their beliefs and is often considered to be too subjective (Bryman 2012).

4.5. Research Strategies

There are many ways to collect data for a study. Researchers use techniques that will best answer their research questions and meet their objectives. The choice of data collection method is guided by the research questions, the research objectives, the extent of existing knowledge, the amount of time and other resources available, and the researcher's own

philosophical underpinning. In IS research, several research strategies can be used to conduct qualitative interpretive research. The most common four strategies used for IS research are: action research, ethnography, grounded theory, case study research, and semi-structured interviews (Myers 2010; Myers et al. 2007; Oates 2005).

4.5.1. Grounded Theory

In 1967, Barney and Glaser published an important work entitled *The Discovery of Grounded Theory*. This book defined a research methodology that aims to analytically derive theories of human behaviour from empirical data (Myers 2013). Grounded theory subsequently became a popular research strategy for social science and IS research.

Many scholars have defined the grounded theory. Strauss (1987) provided a detailed definition.

> The methodological thrust of grounded theory is toward the development of theory, without any particular commitment to specific kind of data, lines of research, or theoretical interest. Rather it is a style of doing qualitative analysis that includes some distinct features and the use of a coding paradigm to ensure conceptual development and density.

Myers (2010) defined grounded theory as an inductive methodology that helps the researcher in developing a theoretical account of the characteristic features of a topic while at the same time grounding the explanation in empirical observation or data. The author added that the primary emphasis in this methodology is the generation of theory that is grounded in the data. It is different from the other methods in that it seeks to test a hypothesis that has been formulated by the researcher.

The use of grounded theory methodology in IS studies coincided with the progress of interpretive research. The grounded theory methodology was insignificant in the 1980s, but it progressed to its current mainstream in the IS field (Urquhart et al. 2013). Although the volume of published grounded research was insignificant in the 1980s, since then much more of it has been published in leading IS journals. It has gained much support and has its own special interest group within the Association of Information Systems (Urquhart et al. 2013).

Many IS researchers explain that they are using ‘grounded theory’ in their studies, but what they mean specifically is that they have employed a grounded theory approach (Bryant 2002). In some cases, the term ‘grounded theory’ is used as a stylistic sleight of hand by researchers who are unfamiliar with qualitative research and wish to avoid close description or clarification of their methods (Suddaby 2006). Matavire et al. (2013), explained the alternative grounded theory approaches that have been used in IS and the extent to which each has been used. Their study concluded that there are four primary grounded theory approaches in use. These are (a) the classic grounded theory approach, (b) the evolved grounded theory approach, (c) the use of a grounded theory approach as part of a mixed methodology, and (d) the application of grounded theory techniques, typically for data analysis purposes (Matavire et al. 2013).

4.5.2. Ethnographic Research

Ethnographic research is one of the most in-depth research methods available. Researchers typically spend a large amount of time in the field and observe what people are doing and saying (Myers 2013). This kind of research provides a rich understanding of the social, human, and organisational feature of organisations. Myers (1999) explained that this research method helps the researcher to get closer to ‘where the action is’ and it enables the researcher to understand the broader context within which people work. In ethnographic research, the data is collected through participant observation. Participant observation requires the researcher to spend an extended period in the field and emphasises detailed observational evidence (Yin 2014).

A growing number of IS researchers use the ethnographic method (Harvey et al. 1995; Lee 1991). Myers (1999) explains that knowledge of what happens in the field can provide valuable information to challenge prior assumptions. It helps the researcher to question what is taken for granted. For example, Orlikowski (1991) examined the degree to which IT deployed in work processes facilitates changes in forms of control and forms of organising. The research findings went against much of the IS research literature of the time that suggested that IT would change the existing bureaucratic organisational structures and social relations.

When ethnography is applied to IS, it investigates in-depth and examines the roles of IS from the participants’ viewpoint, keeping in mind their organisational and social settings. The theoretical concepts and models of IS can be challenged from the ethnographic

perspective, as there is a critical gap between managers' views of IS and the theory of IS that creates a proper understanding of the craft (Preston 1991). (Yin 2014) states that the ethnography approach requires a long time in the field for data collection and demands detailed observational evidence. Requiring a long time in the field and detailed observational evidence is challenging in general and in the IS field.

The different benefits and limitations of ethnography have been explained by Myers (1999). The author stated that the advantage of ethnography is that it shows what people are doing and saying, and it is useful to notice the reactions of individuals in relationship networks. The most valued feature of ethnographic research is its depth. A researcher who is in the field for a long period observes what the people are doing and saying. This can give a deep understanding of those people, the organisation, and the broader context that they operate and evolve in. The major drawback of the method is the long time spent collecting the data, and in this approach, only one situation can be studied (Grills 1998).

4.5.3. Case Study Research

A case study is a research approach that involves an empirical analysis of a particular existing phenomenon in its real life context using various sources of evidence (Saunders et al. 2007). Benbasat et al. (1987) explain that:

> A case study examines a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or a few entities (people, groups, or organisations). The boundaries of the phenomenon are not clearly evident at the outset of the research, and no experimental control or manipulation is used.

Yin (2014) emphasised the importance of context in a case study where the boundaries between the phenomenon being studied and its context are not clearly evident. The case study approach is different from the experimental strategy where the researcher takes control of the context and different from a survey, where the context is limited by the number of variables for which data can be collected. The case study approach is necessary for social science research when it is essential to gain a rich understanding of the context of the research and the process being enacted (Morris and Wood 1991). Case studies also have the advantage of answering the question 'Why?' as well as 'How?' and are often

used in explanatory and exploratory research (Saunders et al. 2007). An exploratory study looks at ways to discover what is happening and seeks new insight of the phenomena while explanatory research aims to establish causal relationships between variables (Robson 2002).

The advantage of case study research is that it can be used with any philosophical perspective; it can be positivist, interpretive, or critical (Yin 2014). This research method usually combines several qualitative data collection methods, such as interviews, documentation, and observations. It also can include quantitative data, such as questionnaires and time series (Dubé et al. 2003).

In IS research, the case study approach has gained respect for several reasons. Benbasat et al. (1987) explained that first, the object of IS research is often IS in organisations, where the interest shifts to organisational rather than technical issues. Second, case studies allow practitioners as well as researchers to keep up with the immediate changes happening in the IT world and in organisations, as it is possible to have access to real-life reporting of IT experiences (Benbasat et al. 1987). Third, holistic investigation, which is a fundamental characteristic of case study research, fits well with the researchers' need to understand the complex and global interactions among organisations, technologies, and people (Dubé et al. 2003).

4.5.4. Focus Groups

Another data collection method used in interpretive case studies is focus group discussions. Kitzinger (1994) defined focus groups as 'group discussions organised to explore a particular set of issues, such as people's view and experience of contraception, drink driving, nutrition or mental illness' (Kitzinger 1994). The value of the focus groups lies in the value it provides to analyse the interaction between participants, and it can also provide insight into the experience of individual members (Burton 2011). Since the area of the current research is new, it is important to gather as many data as possible to make a genuine contribution. Focus groups can help to look at the issues concerning different stakeholders of this project; it would be difficult to capture these using interviews as the only method. Moreover, many lower-level employees will be interviewed, some of them

women and this might offend certain Omani cultural sensitivities. Focus groups can help all participants to express their opinions with confidence.

4.5.5. Action Research

Another data collection method is action research. This is a well-recognised research method that has been used in the social sciences since the mid-twentieth century, and the interest in IS for this kind of research increased toward the end of the 1990s (Baskerville 1999).

Action research is an approach where the researcher and client work together to diagnose a problem and find a solution based on the diagnosis (Bryman 2012). The action research approach is a very useful method since it provides the ability to work and partner with members of the organisation that is the focus of the case study. The advantage of action research is that it can be used with interviews, focus groups, and any other approach. Action research also helps the organisation involved, as it can benefit from the research for the future project implementation (Bryman 2012).

This method yields highly related research results because 'it is grounded in practical action, aimed at solving an immediate problem situation while carefully informing theory' (Baskerville 1999).

4.5.6. Rationale for the Use of a Case Study

There are many ways to collect data for a study. Different researchers use a variety of techniques to collect their data, as long as their techniques will answer the research questions and meet the researcher's objectives.

It is easy to fall into the trap of thinking that one research type is better than another. Every research approach is better in different ways and for doing different things. Which is better will depend on the research questions (Bryman et al. 2007). Therefore, it is important to be clear about the research question before deciding on the research position for the research.

The research question for the current research suggests that the case study approach is best suited to finding answers to it. This research investigates how do institutional forces affect the implementation of government cloud computing? and what organisational practices can lead to the adoption and implementation of cloud computing in government? Benbasat et al. (1987) argued that the case study approach is a well-established method for studying and analysing IS data.

This research project has attempted to distil a clear understanding of how institutional forces affect the implementation of government cloud computing and the organisational practices that can lead to the adoption and implementation of cloud computing in government as a whole. The approach it uses is a single case study with embedded units of analysis (Yin 2014). The focus of this study is not mainly concerned with comparisons or the causal effects of adoption and implementation between the different units of the government. Instead, it focusses on creating a holistic understanding of what influenced the adoption and then the implementation of government cloud applications by government units operating under the civil service law of Oman. Experiences from different government units highlight the effects of the forces studied in those institutions.

The level of analysis of this research is the national organisation, as the G-Cloud project is being implemented by a national government organisation that serves a number of government agencies. Moreover, different government entities are now utilising (or in the process of utilising) the G-Cloud. This type of case study can be described as having an embedded (multiple units of analysis) single-case design (Yin 2014). Yin (2014) identified five reasons for choosing a single-case study: when it is a critical, unusual, ordinary, revelatory or a longitudinal study. Moreover, the case study approach used by many IS studies when investigating the technology adoption topics in the organisational context and specifically if the unit of analysis was an organisation(Choudrie et al. 2005). Figure 4.2 explains the embedded case study approach within the content of Oman Government Cloud Computing program.

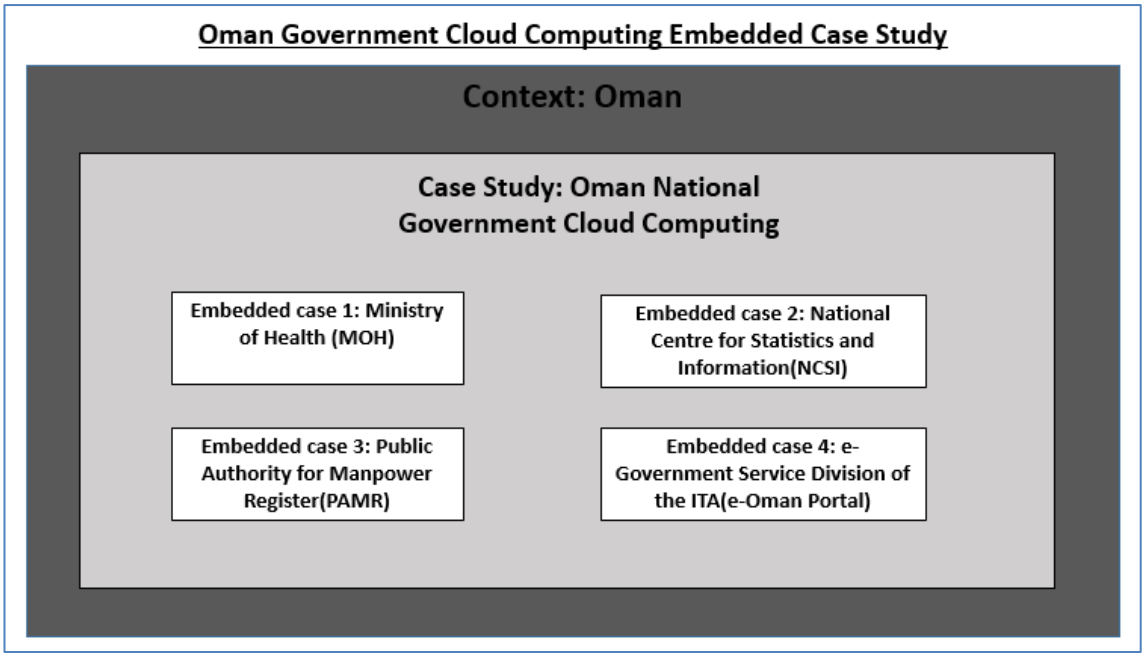

Figure 4-2: Oman Government Cloud Computing Embedded Case Study

While conducting an embedded single-case study, it is important to avoid the drawbacks related to this kind of research. One of the drawbacks would be if the case study focused only on the subunit level and did not return to the larger unit of analysis. It is important to know whether the study focuses on individuals or the subunit organisation (Yin 2014). This study focuses on the cloud computing programme adopted by Oman's Information Technology Authority (ITA), and the subunits of analysis are the government agencies that have adopted and implemented their e-portals into the G-Cloud.

This study will follow the interview guidelines described by Schultze et al. (2011). The authors of these explain that more focus is needed on generating rich data during interviews. These guidelines are: (a) the method's ability to produce rich data about interviewees' experiences of their life-worlds and the meanings related to it, (b) the method's ability to identify the challenges of interviewing as a data generation method (the localist view), and (c) the researcher's own experience with IS research methods.

4.6. Case Selection and Background

The research questions are: (a) how do institutional forces affect the implementation of government cloud computing? and (b) what organisational practices can lead to the

adoption and implementation of cloud computing in government? The case study used to explore these questions is that of the Omani National Government Cloud Computing Programme. The units of study include several government organisations associated with this project.

4.7. Data collection

The fieldwork for this case study took place between June 2015 and December 2015. Data collection mainly took place in the premises of Oman's Information Technology Authority and the government agencies who were migrating (or had migrated) their e-portals to the G-Cloud.

The initial stage of the research explored the phenomena and issues related to G-Cloud adoption and implementation, and the researchers conducted exploratory interviews with key personnel related to this. The objective of the initial stage was to gain a better understanding of the motivations for establishing government cloud computing in Oman by discussing it with the project managers and team members involved in the project. The main data collection involved visiting various organisation who were involved in Oman's National G-Cloud Programme.

There are six primary sources of information for case studies: interviews, documentation, archival records, participant observation, direct observation, physical artefacts (Yin 2014), and online secondary data. Silverman (2006) identified four methods adopted by qualitative researchers: analysing texts and documents, observations, interviews, and recording and transcribing.

The primary data collection method used for this research was semi-structured interviews. The interview is one of the most shared and sensitive data gathering tools in qualitative research (Myers et al. 2007). The interview can be used with either positivist, interpretive, or critical epistemologies and is used in action research, grounded theory, case studies, and ethnographic research (Northcutt et al. 2004). Face-to-face interviews give respondents greater motivation to participate than questionnaires (Gorden 1980). Fontana and Frey (2000) list most common types of interviews:

1. Structured interviews, where the full script has been written beforehand, and there is room for changes later (used for quantitative research)
2. Semi-structured interviews, where the script is not complete, and questions can be prepared beforehand, but the interviewer can add to them and improve on them while interviewing
3. Group interviews, where two or more people are interviewed at the same time; the interview can be structured or semi-structured (Fontana et al. 2000).

Qualitative research typically uses unstructured and semi-structured interviews (Bryman 2012).

The research used semi-structured interviews, as these are useful for exploring difference and inconsistency and examining 'why' and 'how often' questions (Burton 2011). In these interviews, the researcher has a list of open-ended questions, and the interviewee is given a large degree of flexibility in replying (Bryman 2012). This helps the researcher by giving the respondent some control over the pace and direction of the interview. A semi-structured interview helps the researcher to extend the topic into areas that the respondent feels to be relevant. In this research, structured interviews would not have allowed respondents to give reasons for their beliefs or feelings about the implementation of new IS technology. This is critical, as cloud computing is a new concept in ICT. The ability to be flexible with the respondents was necessary to discover what is untold about this emerging concept, especially when it is implemented in government agencies through the government's central ITA.

The semi-structured interview questions were developed using the literature review and the theoretical underpinning of the research. These helped the researcher to shape questions that were relevant the research questions and theoretical background. The interviews sought the perspectives of the key stakeholder groups: organisation staff and managers, technical and IT Manager, and vendors.

The theoretical framework in this study has emerged during the first stage of data analysis. The interview guide was developed to ask open questions related to participants understanding and experience of the cloud computing project. To validate this interview guide, the researcher formed an expert panel of three academic researchers and requested they review the interview guide in view of the developed framework. The panel members provided constructive comments on the relationship between the framework/theoretical

constructs and the interview guide, which the researcher implemented. Appendix F shows the details of the expert panel members.

This study conducted 34 interviews (see Table 4.4 below). The interviews were conducted in Oman in a number of different organisations with people involved in the National G-Cloud Programme. ITA was the main sponsoring organisation, and interviews were held with most of the employees in the programme. The study also interviewed employees and the vendors of the four government agencies who had adopted and implemented the G-Cloud. Interviews typically lasted from 30 to 90 minutes with an average duration of 60 minutes.

The study also conducted one focus group interview with three employees from the Ministry of Health. The researcher engaged with all the participants in the focus group to encourage them to participate in the conversation and express their views about the topic. The researcher introduced the topic and facilitated the interchange. The interviewees were newly hired females providing support for the e-health portal project. The aim of the focus group was to explore the participants' views of the National G-Cloud Programme and the issues faced during its adoption and implementation.

This research also reviewed documents related to National G-Cloud Programme. These documents varied from reports, PowerPoint presentations, prospectuses, and requests for proposals (RFPs). Other documents collected included letters, memoranda, e-mail correspondence, an official publication, journals, branch literature, and brochures. Secondary documents included news clippings and articles appearing in the mass media; however, the quality of these differed, and efforts were made to verify their reliability. The most reliable sources were documents from government agencies, which were collected whenever possible. These gave an inside view of how the G-Cloud was being adopted and implemented and other details related to the research. Gathering this information was not easy, as some government organisations saw it as confidential.

Table 4-4 Interview participants

Agency	Management	Technicians	Vendors	Total
ITA	4	4	2	10
Government Agency A (MOH)[a]	5	5	2	12
Government Agency B (NCSI)[b]	2	2	0	4
Government Agency C (PAMR)[c]	2	0	2	4
Government Agency D (eOman Portal)	1	1	0	2
Others	2	0	0	2
Total Interviewees	16	12	6	34

[a] Ministry of Health
[b] National Centre for Statistics and Information
[c] Public Authority for Manpower Register

In relation to the theoretical saturation and theoretical sampling, this research has explained these concepts based on the selection of the organisation, selection of the participants in the study (the interviewees), and selection of the documents and other sources which this research has reviewed.

Eisenhardt (1989) explained that there are two critical issues related to saturation points of numbers of cases included in research and stopping iterating between theory and data. The author explains that researchers should stop adding cases when theoretical saturation is reached and when the incremental improvement to theory is minimal.

There are differing opinions about the appropriate number of interviewees (Creswell 2013; Yin 2014). Some scholars recommend looking at precedents to determine sample size (Marshall et al. 2013). However, this research opted for including all cases that had adopted the National G-Cloud Programme at the time of the study. Other government agencies were interested in being part of the G-Cloud but they had not started the adoption and implementation process. Therefore, they were not included in this research.

Onwuegbuzie and Leech (2007) discussed the number of interviews required and recommended that 'before deciding on an appropriate sample size, qualitative researchers should consider identifying a corpus of interpretive studies that used the same design as in the proposed study (e.g., grounded theory, ethnography) and wherein the data saturation was reached' (p.118). Researchers often estimate and validate sample size by quoting similar researchers who claimed data saturation at certain points (Marshall et al. 2013). Saunders et al. (2007) noted that many research textbooks suggest continuing to collect qualitative data by conducting additional interviews until data saturation is reached and any additional data would provide little if any further insight. Fossey et al. (2002) suggested that sampling should continue in a qualitative study until themes are fully developed, and more sampling is considered redundant. This happens when patterns start recurring, and no new information appears.

On the other hand, Luborsky and Rubinstein (1995) proposed that in a qualitative study, it is unnecessary to determine the sampling size and techniques in advance, as they are to be discovered throughout the duration of the fieldwork. This study adopted the perspective of Saunders et al. (2007) that the number of participating organisations should not be predetermined. Saturation point for this research was determined to be reached after including four government units in the sample.

Initial respondents were selected using purposeful sampling. Subsequent respondents were then selected using snowball sampling. During interviews, respondents recommended other respondents from the same or another organisation. Data saturation was achieved when the researcher was satisfied that no new information or ideas were coming from the interviews, after which no further interviews were conducted.

The method of selecting documents for analysis was by accessing websites related to this project. The researcher found a large amount of data on the websites of the organisations studied, including policy documents, documents about data security standards, and guidelines for G-Cloud implementation. The researcher utilised chat groups on WhatsApp (the online chat application) to collect secondary data. The researcher was able to access, by invitation, the WhatsApp chat group of one of the IT groups in Oman working on electronic transformation. Information was gathered about recent issues related to the adoption and implementation of the G-Cloud by government organisations. This group discussed IS and government issues freely and (in some cases) anonymously,

which presented an excellent opportunity for the researcher to be an observer of these conversations. It was also an opportunity to ask questions and get feedback from many professionals.

The researcher has continued collecting all possible documents and other sources to support the case study. These documents and the other sources have supported the other methods of data collection. They have reached the saturation after redundancies have appeared.

Table 4-4: List secondary sources used to collect data

#	Name of the Secondary sources	Description
1	Websites	All the websites for the case studies which have been selected have been looked at and used as a secondary data. For example: • https://www.ita.gov.om/ITAPortal/ITA/default.aspx • https://www.moh.gov.om/ar/1 • https://www.ncsi.gov.om/Pages/NCSI.aspx
2	PowerPoint Presentations	Powerpoint presentations from different agencies used. For example PowerPints Slide for G-Cloud Project, e-government strategy of Oman
3	Documents	Various documents have been collected for the purpose of the secondary data. For Example, From the security Division in ITA, the security standards documents have been collected to study the various standards. Another example, is the service request form by the G-Cloud team for their client who is hosted in G-Cloud.
4	What's App Chat groups	What's App groups have been used for observation of discussions related to the G-Cloud implementations.
5	Newspapers	News related to the National Program of G-Cloud implementation were collected.

The choice of the interviewees was informed by the snowball effect. When the researcher started the first interview, the interviewee has informed the researcher about the potential respondents to interview. The researcher then started interviewing others who also

suggested possible people to be interviewed. This also happened for other embedded case where one government agency referred to another government agency as a potential to interview their employees. For anonymity purposes, the name of the interviewees was hidden, and the job type has been categorised as manager, user, technician and vendor.

Regarding on how the empirical evidence informed by the theory, it should be noted that the researcher has selected the theoretical lens during the data collection process and when themes emerged from the data collection that indicated the existence of forces that are pushing and guiding the implementation. The theoretical lens was not a starting point for data collection but emerged during the process of data collection. Table 4.6 list all the secondary sources which have used to collect the data

4.8. Data Analysis Techniques

Regarding the role of the theoretical lens in data collection and analysis, it should be noted that the researcher has selected the theoretical lens during the data collection process and when themes emerged from the data collection that indicated the existence of forces that are pushing and guiding the implementation. The theoretical lens was not a starting point for data collection but emerged during the process of data collection.

The data analysis requires organising the data collected, breaking these data into manageable units, combining them, looking for patterns, and seeing what is important and what is to be learned (Bogdan et al. 2006). Miles et al. (1994) observed that qualitative data analysis is not a sequential process, rather it is an interactive process which involves three activities: data reduction, data display, and verifying conclusions (see Figure 4.1). Data reduction is the process of choosing, streamlining, abstracting and transforming the raw data. Data display is the organised assembly of information to enable the drawing of conclusions. Drawing and verifying conclusions requires extracting meaning from the data and building logical chains of evidence (Miles et al. 1994).

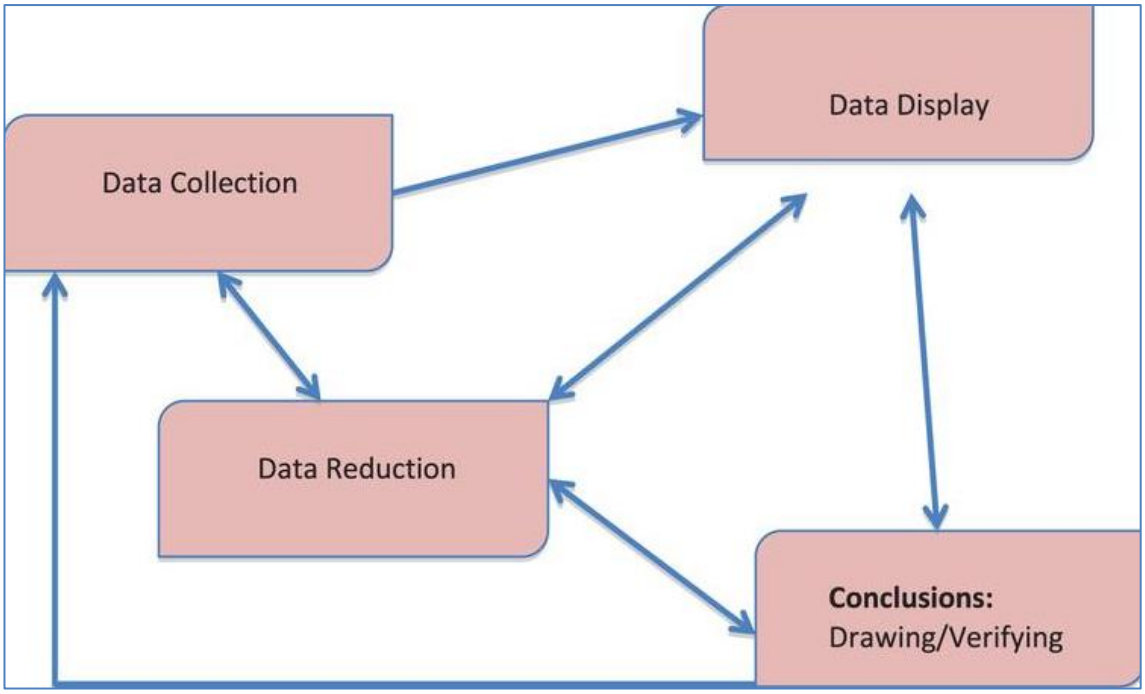

Figure 4-3: Components of Data Analysis: Interactive Model – Source: (Miles and Huberman 1994)

Data analysis for this research started during and after the data collection process. To prepare for analysis, the interviews were transcribed, and some of the interviews were translated before transcription. Transcription is the process of converting a recorded voice interview to writing. The researcher performed the process of transcription which created an opportunity for him to relive the interviews. The process was time-consuming because it involves not only transcribing what is said but also trying to note the tone of voice. It is important to transcribe immediately after each interview to avoid having a backlog of untranscribed interviews. The data collected through the semi-structured interview approach requires strong interpretive and analytic skills. Unless data collection and analysis is carried in an orderly, systematic manner, the researcher can be overwhelmed by the volume of data. Qualitative studies can produce a large amount of data that is easily adaptable to manipulation or analysis (Yin 2014). Careful report preparation is particularly important in interpretative case studies, as researchers are not claiming to report facts but rather they are reporting their interpretations of other people's interpretations (Walsham 1995). The results drawn from the interviews analysis were complemented by results drawn from the content analysis of secondary data.

This research used thematic analysis techniques to analyse the data. The analytical technique proposed by Miles et al. (1994) was followed. The authors recommended that the codes used for analysis should be related to the conceptual framework developed from previous theory, rather than being a random collection of categories. During the early stages data analysis, concepts related to institutional forces were prominent. Hence this theoretical framework was adopted, and data was further collected and analysed accordingly. Analysis of this study was informed by the theoretical framework depicted in Figure 3.1. However, the researcher was open to data recognising other emerging themes and ideas and did not force that data into the theoretical framework. Creswell (2013) suggests that the process of data analysis consists in making sense of the text by conducting different analyses, moving deeper into understanding the data, and finding ways to represent it to allow interpretation of its larger meaning. The analysis starts by identifying redundant issues and focuses on the way the people talk and gesture. The data was encoded using NVivo (software that supports qualitative and mixed methods research) to find common themes between them. The analysis shifted back and forth between data collection and data analysis, which helped the researchers to move with the data and understand the unique and untold aspects of the phenomenon.

The data analysis process was divided into two major stages: first cycle coding and second cycle coding (Miles et al. 2013). The first cycle involved coding the data using an open-coded concept. There are many approaches to first cycle coding, and one of them is using NVivo coding (Miles et al. 2013)[4].

In recent years, there have been many arguments about the importance and benefits of using computer-based software for qualitative data analysis (Creswell 2009; Easterby-Smith et al., 2008b; Miles and Huberman 1994). A number of qualitative researchers advocate the use of software packages such as NVivo and Atlas.ti to help in developing solid and transparent qualitative data analysis (Myers, 2009; Robson, 2002; Weitzman, 2000). Flick (2008) recognised three main advantages of using computer software for analysing qualitative data: it takes less time than manual processes, it gives a consistency to the analytical processes that improve the validity of the research, and it improves data representation (Flick 2008).

[4] See Appendix E for examples of 1st cycle codes and 2nd cycle codes

NVivo 10 was used to help in exploring the qualitative content analysis of the transcripts of the semi-structured interviews, focus groups, and the documents. NVivo 10 expedited and simplified the mechanical aspects of data analysis. It was found to be a valuable tool for coding large quantities of unstructured texts, and it allowed the development of themes and a more systematic analysis of data. NVivo 10 provided an effective and transparent way to code and search for relevant segments of text. This process would have been difficult and time-consuming to conduct manually[5].

Several codes emerged during the first cycle, which were grouped into categories and themes in the second cycle. The subsequent data analysis used thematic analysis that was informed by the institutional forces derived from institutional theory (DiMaggio et al. 1991). The themes and codes in data analysis were based on individual organisations.

In summary, the data analysis stage started by entering all the interview data into NVivo. The next step started by going over each transcription and adding initial codes. The number of codes increased as more interviews were analysed. The codes were then put into categories and concepts. Later, the categories and concepts were checked again. Several iterations were then conducted to follow the principle of the hermeneutic circle described in table 4.2 (Klein et al. 1999). Later, these categories were put into the institutional forces diagram and refined to come up with the final analysis.

The research used a cross-case analysis to present an in-depth interpretation and discussion of the main findings. Each institutional force was used across all cases to highlight the organisational practices and compare each practice with other cases. This approach allowed analysis of cross cases by comparing and investigation of a particular phenomenon in diverse settings (Yin 2014).

4.9. Ethical considerations

Ethical considerations are of prime importance in research generally, and particularly so in qualitative research that can have unintended consequences if not handled with great discretion (Myers 2013). In this research, all the relevant ethical principles and potential issues were taken into account. First, this research had the approval of Royal Holloway,

[5] See Appendix E for examples,

University of London ethics committee. Second, all participants were informed about the nature and objectives of the research and the interviews and were assured that their input and feedback would be used only in this research and would be kept confidential. Third, the organisations involved were informed about the research, and they welcomed the opportunity to be part of it.

4.10. Conclusions

This chapter has discussed the methodology used for this research study. It began by explaining the research philosophy and approach. It then discussed different research paradigms and the reasons for using an interpretive research methodology. It described several possible research strategies for this study and the rationale for electing to conduct an embedded case study. The process model was elaborated, and the motives for selecting this research model were discussed. The chapter concluded with an explanation of the data collection and analysis technique employed.

5. Chapter Five: Case Study Description

5.1. Introduction

The objective of this chapter is to provide a descriptive explanation of the case study for this research. The case study is about the implementation stage of the National G-Cloud Programme in Oman. This programme involves the adoption and implementation of various government agencies' IT systems into the G-Cloud. The case study investigated and described four different embedded government projects. This chapter starts by describing the country and the organisation in which this research was conducted to provide a better understanding of the factors that influenced the implementation.

The chapter is divided into ten sections, including this introduction. Section 5.2 gives an overview of Oman as the country where the data was collected. Section 5.3 discusses the role of Oman's ITA in promoting information technology in government agencies. Section 5.4 provides a detailed description of Oman's G-Cloud programme. Sections 5.5 to 5.8 describe each case studied for this research. Section 5.9 describes the relationship between the National G-Cloud Programme and the government agencies. Section 5.10 is the conclusion of the chapter.

5.2. Overview of Oman

To give the context of the National G-Cloud Programme and the four government agencies that adopted the G-Cloud as an infrastructure for their e-portals, it is important to provide information about the country in which the project was implemented. The Sultanate of Oman is located on the Arabian Peninsula and is bordered by the United Arab Emirates, Saudi Arabia, and Yemen. Oman has a total area of 305,500 square kilometres (about 119,500 square miles)(Factbook 2017). According to Oman's National Centre for Statistics and Information, the entire population of Oman in 2017 was 4,580,111, 54.2 % of whom were Omani nationals (NCSI 2015a). The Sultanate of Oman is ruled by Sultan Qaboos bin Said Al-said, who succeeded his father on July 23, 1970(Factbook 2017).

Oman is a part of the Gulf Cooperation Council (GCC), which also includes Saudi Arabia, the United Arab Emirates, Qatar, Bahrain, and Kuwait. The GCC objective is to enhance

the integration, coordination, and interconnection between the members in all areas to achieve unity (GCC 2015).

In 2015, the Human Development Index of the United Nations Development Programme considered the GCC countries as 'very highly ranked' in human development, and Oman ranked 52nd in this index (UNDP 2015). GCC countries, including Oman, are doing well compared with other developing countries that allow themselves to be independently studied. They share similar cultural, economic, social, and political characteristics that distinguish them from other developing countries.

5.3. The Information Technology Authority in Oman

ICT plays a major role in public sector developments in Oman. Initially, most ICT-related development in the public sector used technology to automate existing business processes. ICT solutions which involved enhancement of the business processes of organisations were introduced and implemented at later stages. With the advent of the internet, government agencies improved their services by providing online information to its citizens.

The government of Oman acknowledged the importance of ICT to enhance its services to meet citizen's expectation. The government recognised that the development of ICT would not be possible unless there were a national vision and central initiatives to promote ICT in government. To achieve this, in 1998 the National Committee for Information Technology was established to guide Oman's information and communications sector Oman's information and communications sector. The committee was the first government initiative to develop and promote ICT in Oman from the national level (AlShuhi 2014). In April 2000, with a recommendation from this committee, the Information Technology Technical Secretariat (IITS) was formed in the Ministry of National Economy (AlShuhi 2014). An information technology taskforce (ITTF) was formed by IITS to develop an IT vision for Oman(AlShuhi 2014). The ITTF's deliberations produced the following vision statement for Oman's ICT:

> *'The leveraging of information technology and communication in providing collaborative services to the public and private sector and citizens through*

> *electronic means as being the driving force to move the Sultanate forward to the knowledge-based economy and achieve sustainable development'* (ITA 2014a).

Since its establishment, IITS has been directed to develop a national strategy for Oman in collaboration with IT consultants from the Gartner Group. In 2003, a policy was adopted to establish Oman's ICT framework and to create a priority list of the main projects and programmes (ITA 2014b). The general objective of this strategy was to achieve a digital society in Oman (eOman) in which e-government is a subset of the larger policy. From the vision and the strategy, it was clear that legislation was needed to allow the proper development of the ICT sector. Therefore, in March of 2002, the government established the Telecommunication Regulatory Authority (TRA) to implement and monitor the regulatory framework and facilitate the development of the ICT industry (TRA 2014). In 2006, the ITA was established to implement the national IT strategy and national ICT infrastructure project. The vision of the ITA is to 'transform the Sultanate of Oman into a sustainable knowledge society by leveraging information and communication technologies to enhance government services, enrich businesses and empower individuals' (ITA 2014a). The mission of the ITA is to facilitate the implementation of eOman, which consists of a wide range of initiatives and services that are designed to improve the productivity of government services, improve the activities of businesses, empower individuals with skills and knowledge to meet society's requirements and expectations, and to guide Oman towards being a sustainable knowledge-based economy.

The eOman vision was acknowledged and supported by Oman's leader. HM Sultan Qaboos addressed the Oman Council in November 2008 and directed the government to simplify the business processes, adopt technology in its daily operations, and focus on electronic delivery of its services (AlShuhi 2014).

With the vision and mission of eOman, a strategic direction was defined and grouped under six strategic pillars. These strategic pillars summarise the strategic direction of e-Oman, and if translated into initiatives, the project and its milestones would result in achieving a knowledge-based economy. The six strategic pillars were (a) society and human capital development, (b) enhance e-government and e-services, (c) ICT industry development, (d) governance, standards, and regulations, (e) national infrastructure developments, and (f) promotion and awareness (UN 2013).

The major projects initiated since then include: eOman awareness, the Oman government network, the eOman portal, the national e-payment gateway, the National Data Centre, the e-transformation plan, and the Oman G-Cloud Programme (AlShuhi 2014). The National G-Cloud Programme is the focus of this study, and details of it are presented in the next section. Figure 5.1 provides a timeline for the development of IT in Oman since 1998, when the government realised the importance of IS for the development of government services and started introducing initiatives to achieve this.

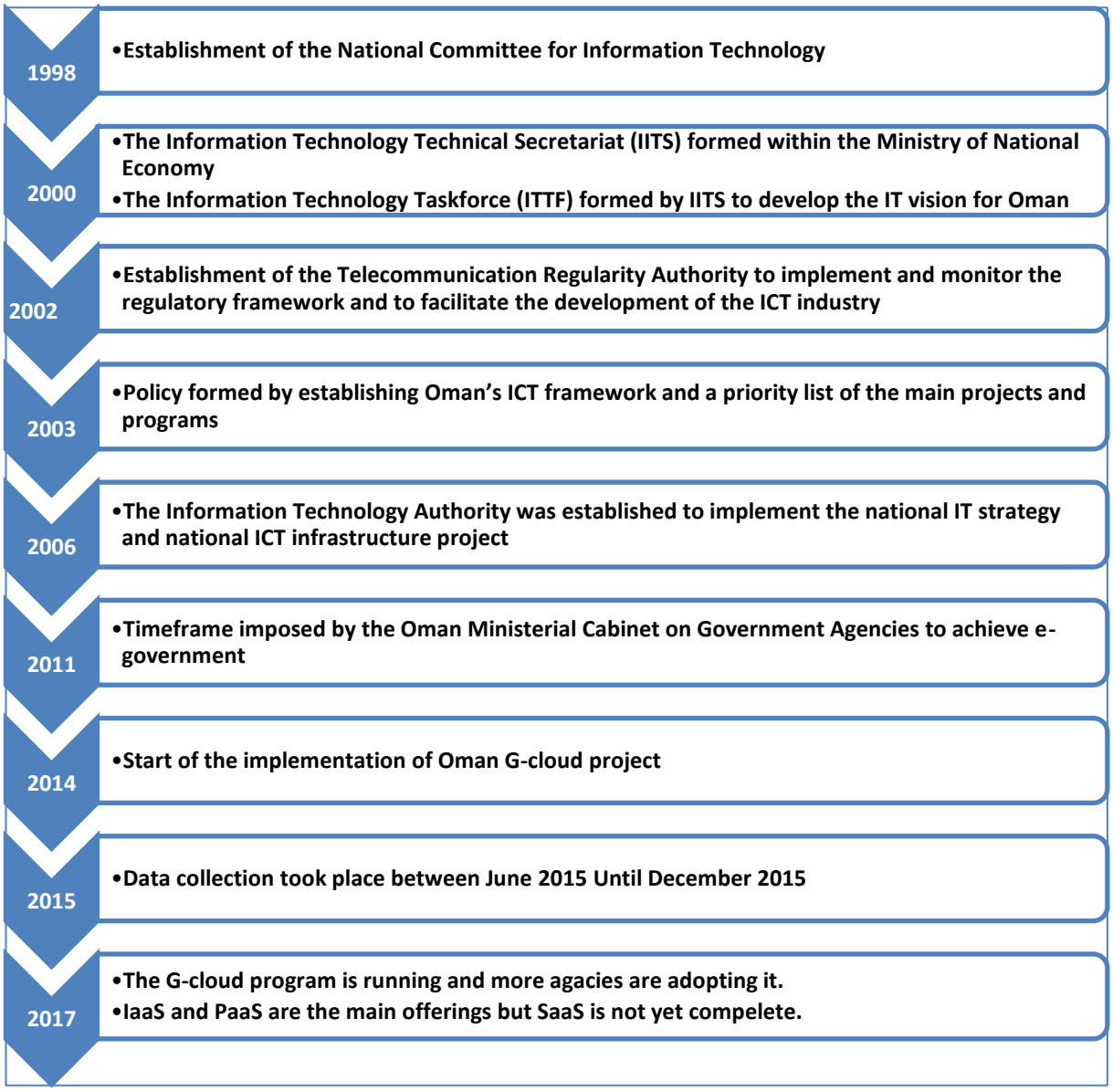

Figure 5-1: Timeline of development of IT in government in Oman

5.4. The National G-Cloud Programme in Oman

The IT infrastructure of many of the government agencies in Oman was not adequate to develop and deliver and their IT projects (ITA 2014b). To overcome the infrastructure challenges, the government, through ITA, focused heavily on introducing IT infrastructure projects. One of these projects was the National G-Cloud in Oman (ITA 2014b).

The National G-Cloud Programme in Oman is a government initiative which started implementation in 2014. The programme is intended to provide services to government agencies in Oman and to set up a shared infrastructure including servers, a network, data storage, and applications to meet the IT infrastructure requirements of all government entities through one government agency. With the G-Cloud in place, government agencies could focus on their core business, reducing the IT budget, increasing their agility, and providing public e-services with greater efficiency (ITA 2015b).

To achieve its e-government objectives and integration, the ITA offered G-Cloud services to all government agencies. At that time, 52 government agencies had a dedicated IT infrastructure but were facing many challenges. Some of these difficulties were a high capital investment with under-utilised capacity; long lead times for procurement and provisioning and therefore a long lead times to establish infrastructures, high capital expenditure (CAPEX) and operating expense (OPEX), and major security issues (ITA 2015b). As well as this, a private cloud would very beneficial for many government agencies by providing a centralised infrastructure for all government agencies. It would also lower national government costs with the expanded utilisation expected to be above 80% (ITA 2014b). Government agencies could save time in the procurement process and the rapid provisioning of IT services since the expertise was available centrally. Moreover, the G-Cloud environment is a highly secure infrastructure, and it allows government agencies to have easy access to other government agencies when they require data from them (ITA 2014b).

With these benefits, the ITA decided to implement the private cloud model. The private cloud is a model where the cloud infrastructure is operated exclusively for an organisation. This model can be managed by the organisation or a third party, and it can be inside the organisation's premises or outside them (Mell et al. 2011). This model is

best suited to a G-Cloud managed by the ITA. Most government agencies are very reluctant to store their data in non-governmental agencies. With this model, the ITA decided to build the G-Cloud using an open source development tool called OpenStack. This tool is used for building and managing cloud computing platforms for public and private clouds. OpenStack is backed by many well-known software developments and hosting companies and by thousands of individual community members (OpenSource.com 2015). Using an open source was a strategic decision to avoid the lock-ins that come with ready-made packages as highlighted by one of the seniors. The ITA realised disadvantage of open source technology as highlighted by one of the senior managers in ITA by saying:

> *'We have adopted the Open Sources technology after deep study; we found out that strategically we will better off with open sources to avid lock-in' ITA02*

The technology is known not being straightforward to use, require more effort on training, upgrades and the of lack skilled staff (Rosenblum 2012). However, the ITA believed the advantages of adopting open-source technology outnumbered the disadvantages of off-the-shelf technology. On December 19, 2013, the ITA signed an agreement with Nortal, an international software development company, for the supply, design, delivery, implementation, and operation of the G-Cloud for three years(Observer 2013).

5.4.1. The ITA's G-Cloud Roadmap

Government agencies expressed their interest in benefitting from G-Cloud services even before the ITA was officially marketing or offering the services (ITA 2015b). To make sure that the service provided quality, the ITA developed a G-Cloud roadmap in which the transformation starts by optimising existing assets/processes and leveraging best-in-class technology at each transition. Each step improves efficiency and effectiveness and can be measured by business returns. An organisation can move to the G-Cloud systematically, taking one step at a time. Organisations can also move to a public or private cloud deployment if it aligns best with their strategic vision for the business (ITA 2014b).

The ITA proposal was to investigate and understand each government agency's options and lay out a roadmap for its cloud computing implementation (ITA 2014b). To make sure that each government agency was ready, its existing infrastructure required the

implementation of a dynamic infrastructure. An organisation needed to consolidate its servers and storage, implement virtualisation technologies to increase utilisation, standardise processes for operational efficiency, automate procedures for more flexible delivery, and enable clients for self-service. It then needed to identify common workloads and set up shared resources. Finally, to achieve a real cloud-enabled environment, clients had to be able to provision the workloads in a dynamic fashion (ITA 2014b).

Different services were planned to be introduced in each phase. At the first stage, the ITA planned to offer IaaS. IaaS includes virtual servers, operating systems, storage, Disaster Recovery (DR), and backup services. PaaS was introduced with IaaS. PaaS services are a database, middleware, test and development tools, and the environment. Most SaaS was expected to be introduced in later stages and was not planned to be offered to government agencies starting to implement their application in the G-Cloud(ITA 2014b). However, services such as public key infrastructure (PKI) and an e-payment gateway are considered to be SaaS and were provided by the ITA to G-Cloud clients as the main component of any services it offered. Other SaaS services such as email, Customer Relationship Management (CRM), and contact-centre services were to be introduced gradually at a later stage(ITA 2014b). Data as a Service is also offered by G-Cloud, where entities can benefit from shared data such as the national civil status system (ID number) and commercial registration (CR). When data are collected, the G-Cloud project provided common IT services such as ID management, PKI and e-payment. The common IT services stage allows different government agencies to implement their projects in the G-could. The four government agencies which studied in this research took advantage of some the common IT services that had been completed, such as PKI and the e-payment gateway. Figure 5.2 provides the context and background of Oman's G-Cloud project and identifies some of the milestones.

The ITA had previously tried to impose its standards on the government agencies, but it had not been successful. With the introduction of the G-Cloud as a common infrastructure free of charge, the ITA worked on ways to embed its standards in these government agencies. Embedding standards through the G-Cloud could be expected to create the issues and challenges described in the literature and which needed to be investigated. This issue has been highlighted by another senior manager in ITA by saying:

'Yes the enforcements are coming from us, and we will not allow it unless we are making sure these controls are followed. But in the past because of these services are hosted on their premises or some service providers, we were not able to impose that. Many of them may not even follow these policies. So it will allow for us better enforcement' ITA12

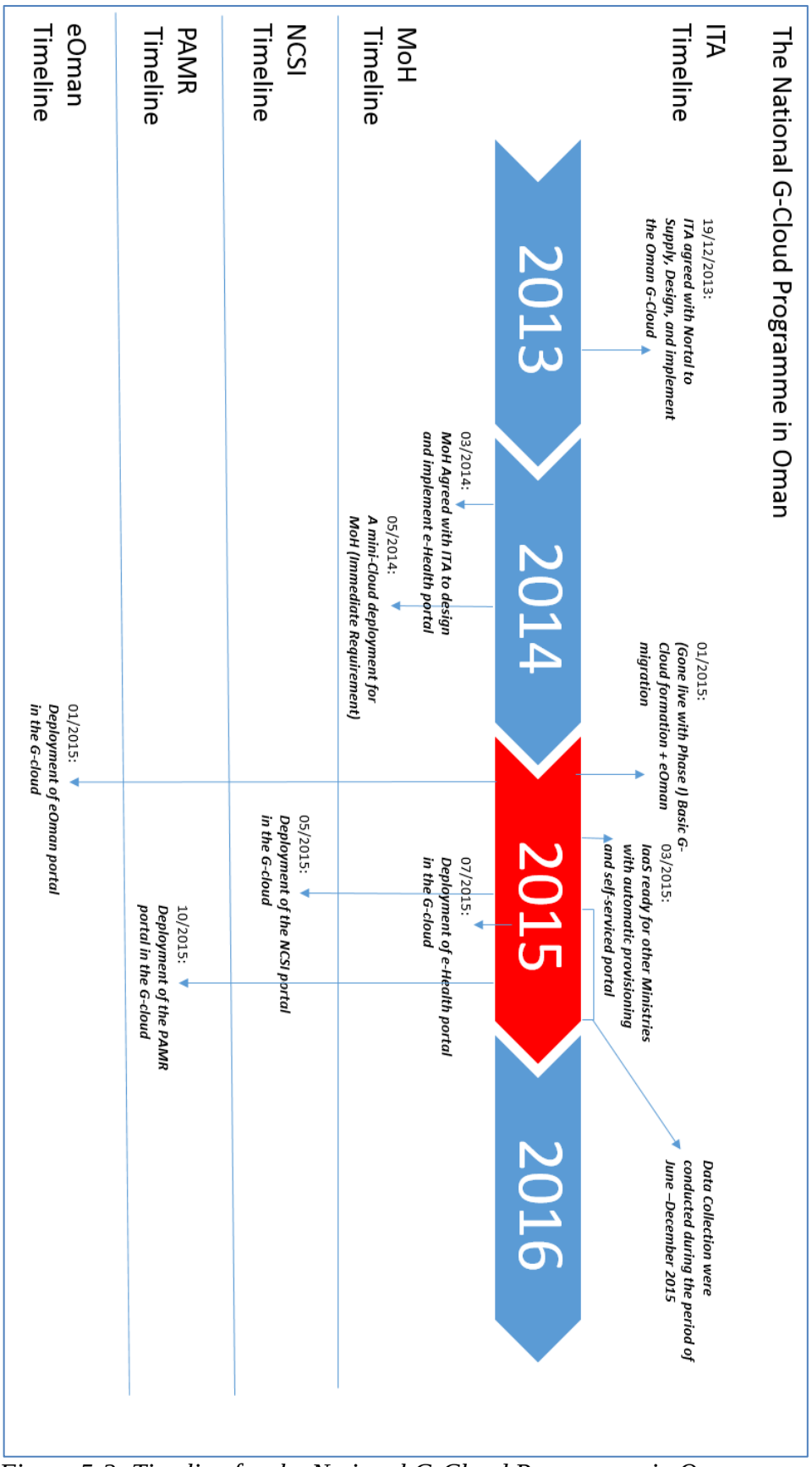

Figure 5-2: Timeline for the National G-Cloud Programme in Oman.

5.4.2. G-Cloud Project Implementations.

The National G-Cloud Programme's objective is to provide a range of benefits to all government agencies. The advantages of these clearly attracted the attention of government agencies who wanted to introduce e-services but did not have the proper IT infrastructure and the financial resources to launch these services. The ITA decided to give priority in the first stage to e-government projects that are shared between government agencies. These included a national ERP project and an Oman business portal. Government agencies that are highly service-oriented, such as the Ministry of Health (MoH), were also given priority to join the G-Cloud (ITA 2014b).

In the early stages of the project, a senior manager in the ITA stated that the ITA target was to launch 15 projects for different government entities by 2015(ITA 2014b). However, as the project progressed, four government agencies had joined the G-Cloud by 2015 we the data collections process started. Many others showed clear interest but were unable to join for different reasons. Some government agencies were very much interested in joining the cloud, but the projects they wanted to be hosted were either delayed or still in the planning stage. In January 2015, the Ministry of Regional Municipalities and Water Resources (MRMWR) approached the ITA to host their proposed CRM application on the G-Cloud, However, by December 2015 their project had not been awarded to a vendor, and they had not yet officially decided to join the G-Cloud as highlight by senior manager in MRWER by saying:

> *'We are definitely going with the G-Cloud, however, we are taking longer time to award our tender to a vendor, but it will be awarded soon' MRMWR01*

The same applied to the Ministry of Environment, which contracted a consultant for its business process re-engineering but awarded its system development to a vendor. Project holdups also delayed the Judiciary Administrative Affairs Council's participation in the G-Cloud.

At the same time, other government agencies had the intention and needed to be part of the National G-Cloud Programme. The ITA decided to offer services that comprised an implementation of an initial IaaS infrastructure with security functions and essential services such as PKI and single sign-in facilities. It invited government agencies to take advantage of this offer to save time and cost for their IS implementations. Government

agencies would own their IT systems, but they would use the G-Cloud as the infrastructure or platform for their system. The government agencies that were potentially interested in benefitting from the G-Cloud were those developing new IS systems, or that wanted to migrate their existing system to the new infrastructure.

During the data collection stage (between June 2015 and December 2015), four government agencies adopted the G-Cloud. These were the MoH e-health portal, the National Centre for Statistics and Information (NCSI) e-portal, the Public Authority for Manpower Register' National Integrated Manpower Register (the PAMR's NIMR) project, and the ITA's eOman portal. Two of these, the health portal and NIMR project, were new projects and were still in the development stage while they were implementing their G-Cloud application. The other two projects, the NCSI portal and the eOman portal, had been completed before the G-Cloud implementation and were migrating to the G-Cloud.

It should be noted that this study only investigated the IT systems of the government agencies which adopted and implemented the G-Cloud. Many other systems in government agencies are not part of the National G-Cloud Programme and therefore not covered by this research. The MoH, for example, has many systems that are not part of the National G-Cloud Programme. The common factor of all the systems that adopted the G-Cloud is that they are online portals for government agencies. The next sections discuss each government agency and the systems that adopted the G-Cloud.

5.5. Ministry of Health e-portal

The MoH is Oman's government agency responsible for the provision, coordination, and stewardship of the health sector. The MOH's objective is to ensure the overall development of the area of health. To achieve this, the MOH is the main architect of the health system design and takes responsibility for ensuring appropriate coordination. It develops policies and programs for the health sector and implements these in coordination with all other related ministries, health service institutions under the government, and those in the private sector(MOHOman 2017). The MOH also advocates for other public systems to make policies favourable to the health sector and to refrain from making policies that may adversely affect the health of the people (ITA 2015a).

Health services in the Sultanate of Oman have made enormous progress. During the early 1970s, there were only two hospitals with 12 beds each and ten clinics. By 2013, the MOH was running 49 hospitals and 195 health centres (MOHOman 2016). The total number of MoH employees was 38,745 according to the Ministry of Civil Service 2014 report (MoCSOman 2014). Along with hospitals and clinics, many departments and divisions play supporting roles. The MoH Directorate General of Information Technology is one of these divisions.

The Directorate General for Information Technology (DGIT) was formed in 2004. Its objective of is the development, maintenance, and support of systems. It falls structurally under the Undersecretary for Planning Affairs. It comprises four departments: the Department of Health Systems, the Department of Databases and Networks, the Department of Communications, and the Department of Technical Support and Maintenance. The 532 IT staff of the MOH administer and develop many applications (MOHOman 2016).

The MOH is one of the pioneer government agencies in IT development in Oman. The Ministry has received many IT awards, such as the United Nations Public Service award as the first-place winner for its Al Shifa Healthcare Information Management System. This award was in the category of Advancing Knowledge Management in Government' (MOHOman 2016).

5.5.1. The e-Health Portal

The MOH acknowledged the importance of introducing new e-services to the public and its employees. Their previous website was a static web page that did not meet citizens' expectations, as many people had already seen how online portals can make interaction with government agencies and the public faster and more efficient. The MoH used to have a separate website for each organisation, and its many hospitals and departments each had their own website. A senior Manager in MoH elaborated on this by saying:

> *'Before I came into this place, we used to have a separate website of each organisation. As you know, the ministry of health is a wide organisation and has many hospitals and entities, and each of them has their website. Again it gave the wrong information and wrong statistics for each site. So we brought all of them*

> *together, and we called the portal like a house, and we are building for each department and each hospital their windows. So all the information we managed under one umbrella, and that is is the concept as we do not allow any department or directorate to operate new website we want them to be under one umbrella.' MOH01*

The decentralised approach allowed the release of much incorrect information and many misleading statistics. The IT department of the MoH decided to move to a centralised system called the e-health portal that would allow all information to be managed under one umbrella. Individual departments or directorates would no longer be able to create their own websites. The establishment of a single, comprehensive website was supported by the ITA who provided human resources and financial assistance for this project (MOHOman 2016).

In March 2014, the MOH and the ITA signed an agreement with ICT Health Company to design and implement the country's e-health portal. The portal is a one-stop access point for users who are seeking information and services from the MoH. The portal provides users with comprehensive and up-to-date information about the announcements, services, and special features offered by the Ministry and its affiliated government agencies. The e-portal's users are citizens, residents, companies, and MOH employees. More than a hundred online services are offered through the e-health portal, which has been introduced gradually since July 2015. The official launch of the portal was on 23 December 2015 (MOHOman 2013a).

The portal allows all MOH governorates (administrative divisions) and hospitals to be on the same site. With the implementation of the e-health portal, the MOH also documented and re-engineered many of the processes. For example, portal administrators do not allow any governorate to directly enter any statistics, as this task is now centralised and part of the planning department. Each governorate is responsible for adding the required information and their own content to the portal. This was formerly the responsibility of the IT Directorate. The senior manager in MoH elaborated by saying:

> *'We added the web content managers, so all the information which is related to any directorate will be added by the web contents managers and not the IT people. All department has to nominate and train them by giving them a workshop on how to use the system on how to enter the information and how to deal with changes.*

> *We want to reduce the pressure on IT side ad these are information assets of themselves. It is also important as they can add and correct information by themselves and take the responsibility.'MOH01*

This is important, as web-content managers can add and correct information by themselves and take responsibility for this (MoHOman 2013b).

The e-Health portal is a combination of systems, some of which were built from scratch, such as the drug and pharmaceutical system, while others are integrated with each other such as Health Information Management, the Alshifa system, and the call centre application. All departments within the MoH are required to follow the standards of the central IT department and work according to these standards to ensure that this project runs successfully. To make sure that every department in MoH is aware of the changes, the IT department has involved the users in the design the implementation stage of the project. This level of involvement has resulted in the successful use of the system, and this success has led to recognition from many organisations. For example, the Alshifa (Health Management) system is recognised as the only system in the world that is used by every doctor and nurse in the country, which won it a United Nations Award (MOHOman 2016). Another Senior Manager in MoH added:

> '*We always work with the users and that what we did with Alshiffa system (The Health Management system in Oman). I can assure you that it is the only system in the world that 100% doctors and nurses are using it is in Oman and that why we got the United Nations Award in the system. You can go and do your research, and you will see no country in the world that 100% are using health Management System.'MOH05*

When the tender for the e-health project was floated, companies were asked to quote on two options, one including hardware and one without it. After the tender was awarded to ICT Health, the MoH decided to adopt the G-Cloud and informed the winning company. Project initiation took two months, and the actual work started in May 2014. The e-Health portal project and the G-Cloud project were initiated at about the same times. The vendor and the e-Health team agreed to use an agile methodology, where they could build a module, go live with it, and then add other modules. This method is helpful to test a full cycle of each module. The e-portal team wanted either the internal IT Infrastructure or the G-Cloud to be ready immediately so they could start their development stage, but the

G-Cloud team was not ready for the agile project management approach. The G-Cloud team, therefore, proposed a 'mini-cloud' to the e-Health implementation team. This was a temporary cloud environment for the e-Health development and testing stage that would be moved to the G-Cloud environment when it became ready. The reason for using the mini-cloud was that the G-Cloud project was still under development and was not ready for any services. The G-Cloud vendor suggested this as a quick cloud computing environment to allow the developers of e-Health portal to start their project. The mini-cloud did not have the standards, controls, or features of the actual G-Cloud. The temporary mini-cloud was seen as an important infrastructure by the e-Health developers. When the G-Cloud environment became ready, the G-Cloud team asked the e-Health team to move all 28 servers from the mini-cloud environment to the G-Cloud. This process took longer than the mini-cloud implementation process, as the G-Cloud came with embedded standards (MoHOman 2013b). The vendor manager for e-Health Portal explains:

> *'The funny thing is that when we started the MoH portal, ITA have just started the G-Cloud project, and they thought we would need the servers after ten months because they did not understand the agile methodology. It was the first time I believe they faced with an agile project. We told them we need the hardware now, as we will create the product backlogs within one month we will finish the first sprint within one month, and we need people to start accessing it. So what they did, they talked to the vendor, and came up with the concept called the mini cloud while doing the proper cloud project on the side and they did mini cloud.'MOH08*

The overall focus of many stakeholders in this project was the implementations of the e-Health portal. The G-Cloud was not their main concern, as they thought it was an infrastructure issue that could be handled by the MoH technical team. The e-Health portal had other problems in integrating different applications inside and outside the MoH. The G-Cloud team helped the portal to integrate with other government agencies and provided the PKI layer with security standards.

5.6. The National Centre for Statistics and Information (NCSI) Portals

The NCSI was established under Royal Decree 12 of 2012. The NCSI vision was:

> ‘To promote and support the production of all official statistics and information to the highest scientific standards, professional ethics, and international best practice and to use the latest communication tools and information technology to provide and facilitate the provision of neutral information in response to the requirements of users’ (NCSI 2015b).

Before the establishment of the NCSI, all statistical data had been produced by the Ministry of National Economy. All the statistical systems and employees relocated to the Centre. Since its establishment, the NCSI team has worked professionally to produce the best output possible. Their efforts are widely recognised, as many organisations use the data they provide, and they use the latest technologies and tools to analyse and process their data.

The NCSI strategic goals include building the statistical capacity of those working in the statistical field so that they can perform their jobs efficiently. It develops national databases as unified, accurate data inventories, undertakes regular and ongoing data updates, utilises modern techniques in statistical work, and uses statistics for innovation and achievement (NCSI 2015b).

The NCSI has seven directorates and is the primary government statistical agency. It has between 250 and 300 employees, and these numbers are constantly growing.

5.6.1. The NCSI Portal and G-Cloud

To achieve the goals and objectives of the NCSI, its stakeholders and employee are required to maximise the use of IT. The use of IT is critical to integration with all related government agencies and to provide data to the public and interested organisations. The NCSI has two portals, the NCSI portal (www.ncsi.gov.om) and the data portal (www.data.gov.om). The NCSI portal is its main website, and all the available information and data are available on that website. The data portal is designed to collect big data from all government agencies. It is not so much a data warehouse as a multiple databases running with populated data. It provides a one-stop-shop platform to navigate indicators and their documents and offers tools for analysis and display, such as maps, dashboards, and data sharing abilities.

When the NCSI team wanted to launch their portal online, they did not have the proper infrastructure, so its management started searching for a location to host their portals. The best candidate at the time was Oman Data Park (ODP), a private Omani company that provides cloud services for government and non-governments organisations. The NCSI contracted with ODP to host its portals. Both portals were launched in January 2015, and they are updated by the NCSI's IT team as required.

In May 2015, the NCSI decided to move both its portals from ODP to the G-Cloud. This was not complicated, as the G-Cloud team had provided forms for the NCSI team to complete, and the G-Cloud team provided the needed space, the RAM (Random Access Memory) capacity, and the platform. The NCSI team migrated copies of the portal to the G-Cloud. At that time, the NCSI contract with ODB was still valid for eight months. This allowed them to test the G-Cloud environment before going live using the G-Cloud infrastructure. The ODP site continued running until the G-Cloud portals were launched and the ODP contract ended. An IT technician in NCSI explains the reason for taking their time by saying:

> "*See, if you have two cars, one of the cars has a problem, then you take your time to fix the other car. But if you have only had one car, then you force yourself to fix it. The same case applied here; we have our data in Oman Data Park, so we already have a place, so we are taking our time to fix things slowly since there is no compulsion to go fast. Second, we cannot move all and want to move only the data portal. Now we have a plan to move within three weeks because we want to be settled with the PKI access. So the delay happened because we had options already up and running and we did not have the proper connectivity.*"

5.7. The Public Authority for Manpower Register NIMR Project

The Public Authority for Manpower Register (PAMR) was established on October 18, 2011 by Royal Decree 98 of 2011. It is legally, financially, and administratively independent and is directly responsible to the Council of Ministers. The authority was established to create an integrated central database for all the country's public and private sectors and enhance human resource policies by recruiting Omani nationals (PAMR

2015). The authority provides human resource data and information to decision makers in public and private organisations.

The Ministry of Manpower was formerly responsible for producing and maintaining all workforce records through its Directorate of Information. In 2011, this Directorate moved to the newly established PAMR. The PAMR was given responsibility as the central recruiter for all public organisations. However, this responsibility was removed from the PAMR in 2013, as it became difficult to manage the recruitment process centrally due to a lack of human resources and technological capabilities at that time.

5.7.1. The PAMR Portal

The PAMR realised the importance of having a robust central recruitment application which is capable of achieving its objectives. The plan was to build a comprehensive database for the entire Omani workforce that was fully integrated with all related government agencies. This would be achieved by designing and implementing a new National Integrated Manpower Register (NIMR). The study and designing period took approximately three years, as the PAMR team wanted comprehensive system and had to explore ideas and solutions from different countries. The tender was released called with the required specifications, including the option of hosting the application in the G-Cloud environment. In July 2015, the tender was awarded to a Singaporean company called Crimson Logic. The company partnered HireCraft, a company that had developed similar systems in many countries. The PAMR chose to host their system in the G-Cloud, which saved five million dollars in hardware costs.

With the NIMR system, the PAMR could collaborate with the other government agencies and private sectors that also had responsibilities for managing the Omani workforce. This has been stated by the The CEO of PAMR by saying:

> *'With the NIMR system, we can collaborate with the other government agencies, military, security and private sectors responsible for manpower, to aggregate job opportunities to make employment information readily accessible to the Omani citizens. I want to thank ITA's efforts for their efforts on this national project. With this system in place, it enables us (PAMR) to work with the various agencies and sectors to plan and develop policies related to the manpower force in Oman, and*

facilitate the procedures for more efficient job applications by citizens' (CrimsonLogic 2015).

The kick-off meeting with the company was in September 2015. The company had gathered all the requirements, and now the project entered the design and development stage. The plan was to go live in September 2016. The ITA team was heavily involved, and a project manager from the ITA made sure that the project would be delivered according to the requirements and inside the timeframe. For this stage, the G-Cloud team provided the PAMR team with a development environment. The creation of the development environment was a straightforward process and was done quickly. The project was expected to finish by the end of 2016 and to integrate with ten other organisations.

The NIMR application is a tool that people can use to register themselves as job seekers. The Vendor of the NIMR project explains how the system works by saying:

"The portal is a tool where all job seekers come and register themselves as job providers. So now if any job is getting posted then all job seeker will be notified. So once they applied, they will come to PAMR, they will review the application and see if they are the right candidate, they will accept, and they and they can see the Job providers detail and then the start the see the application. So, that is the main application in the manpower records application. The other component is the business intelligent report where we will give all the statistical and business intelligent report, as the future trends or the forecasting report, wherein a particular year how many job seekers are coming up to be a job seeker. So up front they can plan. Similarly, the institutions can also plan, where they can plan what are market trends in Job, such as networking or other majors"PAMR03

The system would give accessibility to job seekers living outside the cities of Muscat and Salalah, the only two cities in Oman in which there are PAMR offices. The new system allows job seekers to register online, and it encourages potential users to register themselves(PAMR 2015).

5.8. The e-Government Service Division of the ITA

The e-Government service division is responsible for leading the e-Government transformation plan, offering business consultancy services to all government agencies and providing the required support, training and capacity building programmes for the government transformation working teams (ITA 2014a). This division is also responsible for managing and mainlining the eOman portal. The ITA established this division to provide more support to all government agencies when it realised that many of its projects involving interaction with government agencies were not achieving their objectives.

5.8.1. The eOman Portal project

The eOman services portal is the gateway to services and information for government agencies in Oman. It was launched in 2009, and in 2012 it was rebranded as Omanuna. Users can navigate the portal to access its services directly or find information about where and how to access other services. It includes SMS services and forms that can be download and is designed to be user-friendly by integrating public services across different government agencies under one portal.

The portal was based on an IBM platform and used IBM hardware, but these products were very costly for the ITA. The eOman portal infrastructure needed to be upgraded after four years, and the high cost of maintaining the old infrastructure encouraged the ITA team to look for alternative infrastructure. It decided to implement and then migrate the eOman portal to the G-Cloud (ITA 2015b). In fact, the e-Oman portal was one of the drivers to go for the G-cloud as per one of the managers in ITA who explains:

> "*The idea started a long time back; you know the e-Oman portal project, after four years, it was time for this project to be upgraded. The moment we get the quote from GBM, it was in millions O.R, just the Disaster Recovery and refreshing the hardware for the existing software, and then I and the Deputy CEO asked why we have to spend this much money on this project. Why can't we implement a G-cloud and then migrate e-Oman portal into one component of it? Then the CEO, pushed and push and put the business case, it took us one year until we got the approval, so I put the RFP for that."ITA04*

The ITA management then decided it would be better to invest in an open source G-Cloud solution instead of reinvesting in an IBM product. Migration of the eOman portal to the G-Cloud started in January 2015. It was the first application to be hosted on the G-Cloud.

5.9. The relationship between the ITA and government agencies through the G-Cloud

The G-Cloud Programme is an initiative of the ITA as the main government body responsible for promoting the implementation and use of technology for government agencies. A number of agencies developed their systems in the G-Cloud or migrated their existing systems to it. Four of these were selected as representative case studies to address the phenomena explored by this study. The diagram in Figure 5.3 explains the relationship between the ITA's G-Cloud programme and these four government agencies. This relationship shows the dynamics of adoption and rejection that lie at the heart of this study's research questions.

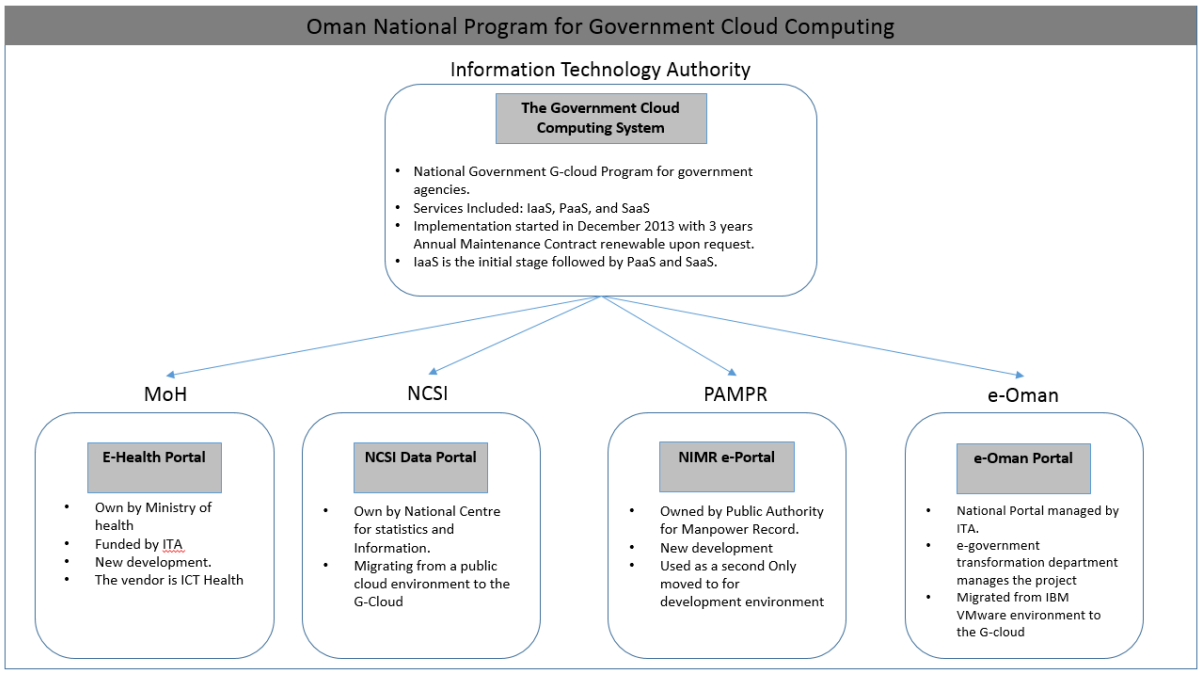

Figure 5-3: The G-Cloud and its relationship with the four government agencies

5.10. Conclusions

This chapter discussed the case study of this research in detail. It started by providing background information about Oman, the country where this case study was conducted. The next sections described the organisation which developed the G-Cloud in Oman and the reasons for implementing ICT infrastructure. The G-Cloud project was described in detail along with the issues and challenges associated with it. The remaining sections described the four government agencies that implemented their projects or application in the G-Cloud.

6. Chapter Six: Research Findings

6.1. Introduction

The objective of this chapter is to present the findings obtained through the analysis of the data gathered and in relation to the framework developed earlier in the theoretical framework chapter. Various data were collected for the case study through the inspiration of theoretical lens of institutional forces. In conducting this analysis, it is important to highlight that this study is looking at institutional forces within the area of information infrastructure studies. In other words, this study identifies existing and new organisational practices based on each institutional force and explains how these practices contribute to the standardisation of information infrastructure. Hence, the study looks at the role played by isomorphic mechanisms/institutional forces in achieving standardisation in information infrastructure implementation. By doing so, this research analyses the empirical findings collected through the qualitative method used in this study. The analysis will help to explain how standardisation could be achieved through institutional isomorphic mechanisms and how it influences the information infrastructure implementation in government.

The case study discusses the implementation stage of the IS projects (government e-portals) of several government agencies within the framework of Oman's National G-Cloud Programme. Within this national programme, four different embedded government agencies were investigated. As noted in chapter three, the research question was approached by using an interpretive worldview; hence, this research attempts to understand this phenomenon through the meanings brought by the participants based on their actual experiences regarding the studied information infrastructure development programme. Alongside the four case studies, the implementation of the G-Cloud within the Information Technology Authority (ITA) is also discussed to help in explaining the findings of other case studies. The ITA took the opportunity of the implementation of the G-Cloud to embed its standards into the G-Cloud system. These standards had scarcely been adopted before the implementation of the G-Cloud as the ITA had faced challenges in imposing them on government agencies. Although the implementation of the G-Cloud does not fall within the scope of this study and is not the main unit of analysis, it is important to highlight the challenges encountered during its implementation as this will lead to a better explanation of how the ITA embedded its standards during the

implementation of the G-Cloud. The implementation of the standards in the G-Cloud will later help to explain how some government agencies rejected or contested them.

The chapter is divided into nine sections, including the introduction. Section 6.2 highlights the organisational practices that led to standardisation of the e-portals in to the G-Cloud. The importance of standardisation is shown by how these G-Cloud standards were embedded in the government agencies' systems. Section 6.3 highlights the institutional forces and standardisation in the G-Cloud implementation. Sections 6.4 to 6.7 discuss the isomorphic forces in each of the embedded case studies. Section 6.8 provides a summary of the organisational practices in the G-Cloud. Chapter 6.9 is the conclusion of the chapter.

6.2. Organisational practices of isomorphism and their impact on standardisation

When, in the second half of 2015, the data collection took place, several projects had adopted the National G-Cloud Programme. Four of these projects were selected because they represented a sample of case studies that highlighted the issues that needed to be addressed. These case studies demonstrate the relationship between the central ITA and the government agencies, which explains the dynamics of adoptions and rejections, and are thus the best suited to help explore the research questions.

The projects which were selected for the study were the MoH e-portal, the ITA e-Oman Portal, the Public Authority for Manpower Register (PAMR) Portal, and the National Centre for Statistics and Information (The NCSI Portal) Data portal. Each of these projects had different implementation requirements that are described in detail in each section. Figure 6.1 explains the relationship that existed between the G-Cloud programme and the projects that were involved in its adoption.

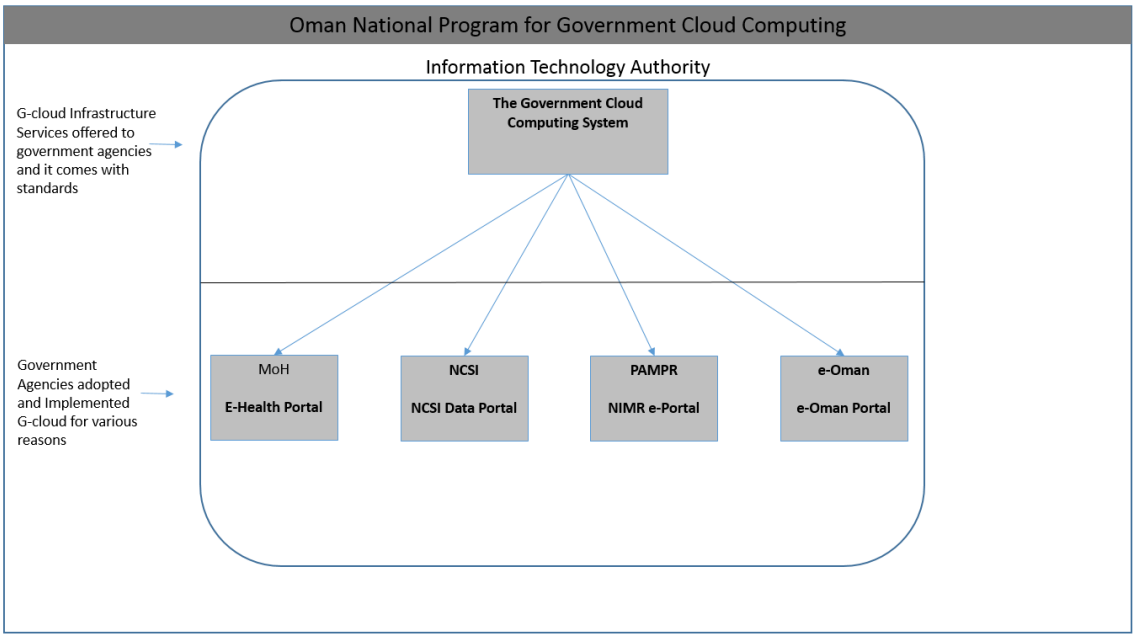

Figure 6-1: The G-Cloud and the government agencies' projects

The study considers the implementation of an information infrastructure and views standardisation as a means to isomorphism, which means that all the projects that were implemented in G-Cloud became similar. Therefore, this study looks at organisational practices that represent institutional forces. These types of organisational practices have been identified in the literature, as explained in the Theoretical Framework chapter, and are associated with the three coercive, normative, and mimetic institutional isomorphic mechanisms or forces. In other words, this study will show how these forces were identified within the organisations and what practices were adopted that the researcher would associate with particular institutional forces. Alongside information management ones, management and organisational studies were also included to find the practices that led to each institutional force. These organisational practices can be categorised into the institutional forces linked to coercive, normative, and mimetic behaviours, which can be described as follows:

1. A coercive force is in play when a practice results in the application of formal or informal pressures by one organisation over another.
2. A normative force unfolds when practices rely on experienced professionals.
3. A mimetic force occurs when technology is poorly understood, and an organisation is uncertain of whether it is right for itself; it thus tends to look at others on which to

model itself. This kind of force is associated with practices that appropriate knowledge or technology from somewhere else.

In each section, the study identifies the different practices that were adopted while joining the G-Cloud and includes any that were not introduced from the literature review. Figure 6.2 shows the different practices of isomorphic mechanisms or forces that were identified in the literature. The framework starts by identifying the various organisational practices and associating each with its related institutional mechanism or force.

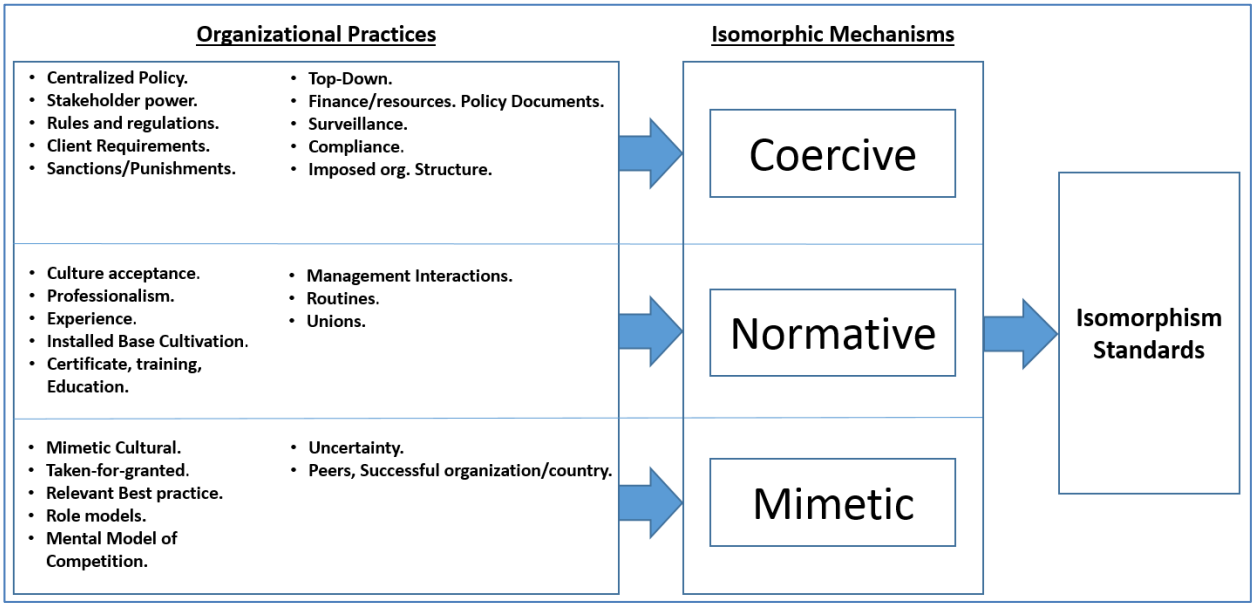

Figure 6-2: The theoretical framework of organisational practices that led to Isomorphic Mechanisms

6.3. Institutional forces and standardisation in the G-Cloud implementation

Looking at the development and implementation of the National G-Cloud Programme in Oman, it can be noticed that there are two levels of organisational practices that can be identified in this embedded case study. First, those practices that occurred during the implementation of the G-Cloud. Second, those practices that took place during the implementation of the four projects in the G-Cloud (which are elaborated upon in the following sections, each dealing with a case study). Although this study does not cover the process of the implementation of the G-Cloud, highlighting the practices that occurred during such process is important as it helps to better explain the implementation of the other projects within the G-Cloud. Some of these practices were depicted in the G-Cloud in the early stages of implementation. Highlighting and explaining these early practices

will help in better explaining how they led to standardisation within the government agency implementations.

During the implementation of the G-Cloud project, various practices were adopted that led to standardisation of the government e-portals that are implemented in the G-Cloud. The national government realised that some of its agencies had not achieved any form of digital development and still needed time to do so. For other government agencies, the lack of an IT infrastructure represented an obstacle to the development of IT systems. With the G-Cloud, the government intended to overcome such information infrastructure challenges.

While this research discusses the organisational practices that led to standardisation, it is important to highlight some of the early challenges faced in the G-Cloud's implementation, which will help elaborate upon other practices in later sections. The implementation process was not a straightforward one, as it was beset by challenges. Although cloud computing, as a concept, is widely implemented nowadays, governmental implementations of this solution are considered to be a new experience. Therefore, the ITA and the G-Cloud vendor had to deal with many unknowns. The vendor stated that the process would have been much easier if it had known which government agencies were joining the G-Cloud. Both the vendor and the ITA project team mentioned that many of the specifications and requirements of the G-Cloud's implementation ***had not been clearly stated***. For example, which government agencies would potentially want to join the G-Cloud and what types of services they would require. One of the vendor's technicians of the G-Cloud in the ITA elaborated upon this by saying:

> '*It would have been very nice that, first, the plan of the possible clients would be collected and what are the requirements, not only when you start the implementation, but there will constantly plan with understanding what the potential clients are and what their potential requirements are, because now we have a base level service, and now we are adjusting to the new customers. I believe this adjustment could have been much faster and cheaper if we had known our potential customers' applications' ITA09, 30/11/2015*

He also believed that they were building a private type of cloud computing with specific objectives to serve government agencies. Had they had more knowledge of which government agencies were going to join the cloud and of what the project requirements

were, less change requests would have been made. He explained that Cloud Computing projects with open specifications take longer to build and are costlier as they include more requirements to provide more services. At the same time, the ITA had approached many government agencies before the implementation stage of the G-Cloud. All the organisations approached had expressed their interest in joining the G-Cloud as it was a national project and its benefits were clear. However, these good intentions were not sufficient for the ITA to include those organisations in the development plan of the G-Cloud. The ITA did not have the authority to ensure that many of those organisations would be obligated to join the G-Cloud. These early challenges or issues linked to implementing the G-Cloud project helped the ITA team to shape how it would approach the government agencies by applying various forms of direct or indirect pressure on them. The ITA used different practices in relation to both the vendor and the government agencies to ensure that the G-Cloud project would lead to standardisation.

The selection of the open-source cloud computing concept from a relevant ***best practice***, an Estonian model, was a mimetic mechanism that led to the standardisation of the system. The ITA sought to find an example successfully implemented in another country as it was ***uncertain*** of what a G-Cloud application should look like or how it would operate. These uncertainties facilitated the application of software standards to the new G-Cloud solution. Moreover, while the ITA was looking for relevant best practices, the ***mimetic culture*** practice was also made visible by the adaptation to a model from a western country. The Estonian model of implementing an Open Source G-Cloud motivated the Omani government as they believed that western culture, which many identify with advanced countries, was a good model to mimic. One of the senior managers in one of the government agencies stated:

> *'The G-Cloud vendor since they are from an advanced country and probably since they are recommending the G-Cloud infrastructure ... That is why they are saying they will get better performance or the issue of performance we are having, the internet on the normal infrastructures, this will disappear when we move to the Cloud. I believe they are right, as they have given the sample for us, maybe they are better, why not try to move' NCSI03, 17/11/2015*

The normative mechanism became evident from the initial stages of the implementation, particularly in the ***training*** of the ITA staff and the experience which needed to be gained

from the vendor. This was evident when the ITA decided to go ahead and implement a National G-Cloud Programme in Oman through a vendor. The ITA took a project management and governance role, while the vendor, Nortal, looked after the technical implementation. Regarding this implementation, the ITA had a shadow team that was working hand in hand with the vendor during the implementation and would be able to retain knowledge when the vendor signed-off. The contract with the vendor was a three-year one pertaining to the implementation and operation of the G-Cloud. Through ***Project Management*** and **Governance**, the ITA showed how it used its **Coercive** forces from the initial stage to lead to the standardisation of the National G-Cloud Programme.

While the G-Cloud project came with standards that had been adopted from best practices and role models by the vendor, the ITA team also had requirements that needed to be embedded in the G-Cloud implementation. The ITA saw itself as a client who had demanded and asked the vendor to follow and implement its requirements in the G-Cloud project. Some of those requirements were the standards that had been agreed in the tender documents, while other had been imposed during the implementation of the project as ***client required***. One of the managers in the ITA explained that:

> *'We are following the security standards in ITA, and we are using the OeGav (Oman e-government framework), I would say, if anyone would like to start a cloud project, they should follow the standards on how to do that, which has been done by Gartner or others. These standards will guide you on what is happening in the market as of today, there might be some changes as we have experienced it, but the change is much better done now than getting into the cloud environment, and then it turns up as something else. That how it should follow some international standard, then we should keep adding to it' ITA05, 27/11/2015*

Although the above statement highlights the client requirements, it also shows the role played by ***professionals***—in this case, Gartner—in helping the ITA to create standards. From the consultants and from their IT experience, the ITA team gained the ***knowledge*** that helped them to include all the requirements or the standards in the initial stages. It also enabled it to leave space to add future standards if required. One of the managers in the ITA highlighted the different kinds of standards that the ITA team decided to adopt through their interactions with the consultants and explained why they were important by saying:

> ‘*First of all, the G-Cloud project needs to comply with many standards, such as security standards, virtual system standards, hypervisor standards, so every layer should comply with NEST standards. Even my RFP came from standard, so we are aligned with NEST standards such 583, 50083 and others, there is at least top ten standards from NEST. We should comply with NEST. Moreover, then the security standards, such HIPPA (Health Security Standards) and CCSK (Certificate of Cloud Security Knowledge) 3.0, so we implemented these standards so that our cloud will be trusted’ ITA06, 30/11/2015*

The above statement shows how the ITA team was focussed upon imposing standards in G-Cloud from an early stage in its development. The ITA team’s professionalism and ***experience*** helped them to include their requirements within the G-Cloud project. Moreover, for the company that was developing the G-Cloud solution, the ITA was a client, and the authority wielded its ‘Client Requirements’ power over the vendor. The vendor was expected to accept the changes, or it might have ended up facing contractual penalties.

Although the standards had been agreed earlier with the vendor, there were also some other standards and requirements that had ***not been clearly stated*** to the vendor. One of the issues was that the G-Cloud needed to run over the MPLS, which was a government secured line. This meant more security and broadband restrictions for the government agencies. One of the Vendor’s managers explained:

> *‘There is also another thing, is that the networking thing is not understood, in general, if you put an application in the G-Cloud, it works great, it does not mean anything if you cannot access, Oman has some complicated network setup, such as Public internet and government network, if you don’t understand who your end-users are, it is really tricky how would you set up your application properly. For example, if you have a ministry that has many branches, some of them cannot be closed by the security policies, all that things and then the idea of the end users’ perspective that your ministry using the G-Cloud but your application does not work. So these technical things are making things complicated’ ITA09, 30/11/2015*

Therefore, the vendor had to deal with the issue of making the G-Cloud application stable before approaching those government agencies that were facing challenges in joining it.

This meant that, in the later stages of its implementation, the G-Cloud would allow non-standard solutions to be implemented to accommodate ITA and Oman network requirements.

Other ministries were interested in joining the G-Cloud but then decided not to for feasibility reasons. For Example, the Ministry of Manpower was interested and was convinced to host a project in the G-Cloud in January 2015. However, it noticed that the G-Cloud, as a project, was ***not mature enough*** and would take a long time to reach a level of maturity at which it could host applications from different governmental agencies. Therefore, the Ministry decided to host its application internally as it already had a full infrastructure to host new applications. A Manager of the IS Department highlighted this by saying:

> *'Although we have shown interest to be part of the G-Cloud to benefit from its offers, we noticed that the ITA were not ready and their G-Cloud infrastructure was not complete. At same time, our organisation has ready infrastructure, so we decided to use our infrastructure' MOMP01, 29/10/2015*

Another concern that might have been an obstacle for some government agencies was the lack of ***clear procedures*** to enable the governmental bodies to apply for and move onto the G-Cloud. This lack could be an obstacle for those government agencies that were about to join the G-Cloud. This issue was highlighted by a staff member of the eOman portal that wanted the G-Cloud to host its data portal; he said:

> *'So I was telling you about open data, we were a customer to the G-Cloud as eOman portal … We were given many feedbacks along the process. If you make the government entities go through this hassles, they will not continue with you. We were telling them exactly if you go on like this, it will be very difficult for you to go on like this and attract the government entities' ITA04, 26/11/2015*

The eOman portal staff member's remark shows how much the organisations were expecting that everything in the G-Cloud would be a straightforward process and that the ITA would be handling everything smoothly. Others felt that it was the vendor's responsibility to manage the application implementation in the G-Cloud. These issues were made clear in the post-implementation stage. Many government agencies expected to have fewer responsibilities over the infrastructure when using the G-Cloud. A senior

manager in the ITA also added that more ***tensions*** were expected to surface as more organisations joined the G-Cloud. He called this stage of the implementation the *'Honeymoon'* by saying:

> *'That is our expectation that the G-Cloud makes the aspect of work easier, but the organisations are the ones who should answer the question, I think, as I told you, we do not have much organisation yet, it is a honeymoon stage. I think this project will be more challenging, as the customers increase, the demand will be higher, the expectation will be higher, SLA could be challenged' ITA03, 26/11/2015.*

The implementation of the G-Cloud by the ITA showed various challenges that were important to explain the case study. Along with the issues and difficulties in the implementation of the G-Cloud, various practices were identified that led to standardisation in the G-Cloud implementation. These early practices adopted by the ITA during the implementation of the G-Cloud resulted in the standardised solution to be contested by the vendor of the G-Cloud, in the first project that was implemented, in regard to the ITA's role in imposing its standards from a higher level. Figure 6.3 shows the different practices that were adopted during the implementation of the G-Cloud project by the ITA.

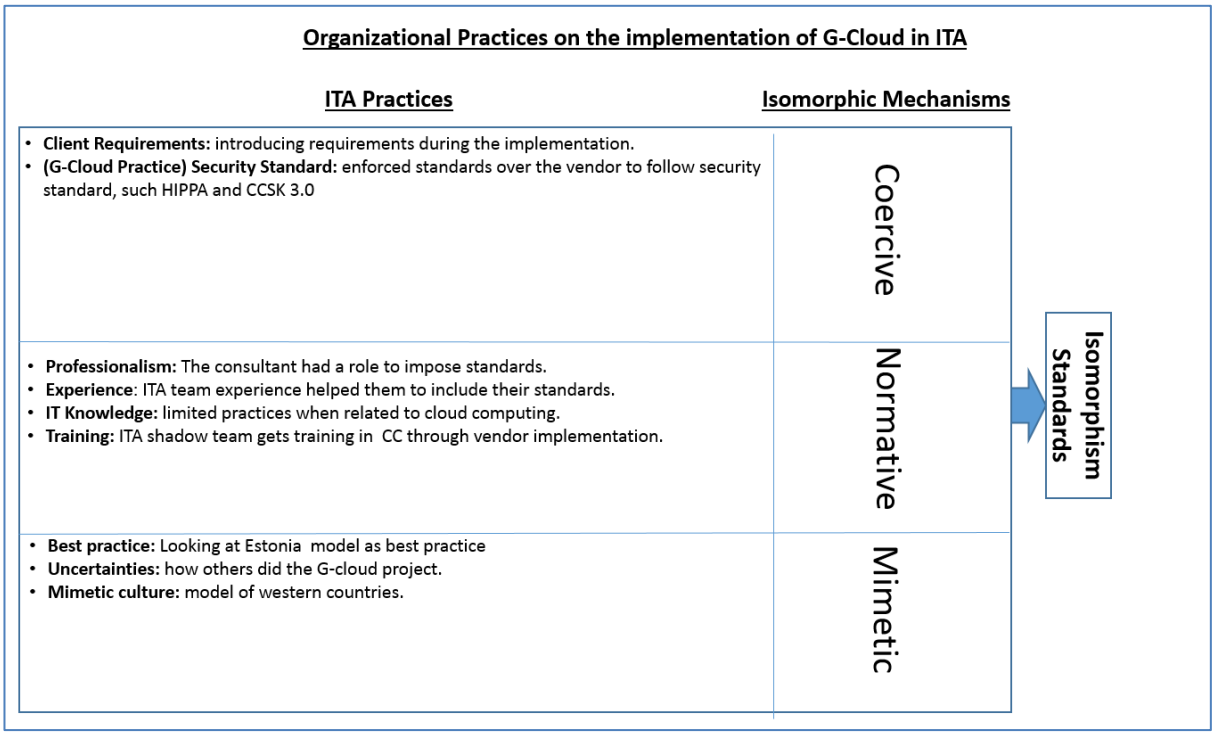

Figure 6-3: Organisational Practices in the implementation of the G-Cloud by the ITA

The figure shows the various organisational practices adopted by the ITA that helped to standardise the G-Cloud solution; this, in turn, reflected upon the implementation of standards by the other government agencies that adopted the G-Cloud as the infrastructure for their applications. All these practices contributed to the standardisation of the G-Cloud. However, as is the case in many system developments, challenges emerged during the implementation stage. Since the G-Cloud was a new project for the ITA, the specifications and requirements were not clearly stated, which caused delays in the completion of the project. Those requirements and specifications included local standards, such as the use of the government-private network (MPLS), of which the vendor did not have any previous experience. Moreover, delays in the project had prompted government agencies to look for alternative infrastructures, as in the case of the Ministry of Manpower, which considered the G-Cloud not to be sufficiently mature. Finally, the lack of clear G-Cloud joining procedures for government agencies was raised by some of the latter's staff members, as they believed that it would contribute to delays in the adoption and implementation of the application into the G-Cloud. All these challenges had been raised as concerns. However, the influence of these challenges on the adoption and implementation of the G-Cloud was minimal, as will be explained later in the study.

6.4. Ministry of Health e-portal organisational practices

The MoH's e-Health portal project was the first outside of the ITA to be hosted in the G-Cloud. Therefore, issues and challenges existed in its early implementation stages. The e-Health portal was a huge project for the MoH and was aimed at changing how it interacted with its clients. This project in itself required many integrations, as there were many different users who had differing requirements. Therefore, various practices led to the standardisation of the G-Cloud in the e-Health portal project. This section identifies and explains the different practices associated with the three coercive, normative, and mimetic institutional forces leading to the standardisation of the MoH's e-Health portal.

6.4.1. Coercive Institutional force

One of the important institutional forces that resulted in the standardisation of the MoH's e-Health portal was the coercive force. Various practices have been identified related to the coercive force. The ITA considered the successful implementation of the e-Health port as essential as it was the first G-Cloud implementation outside of the ITA. It used its authority to ensure that all resources and efforts were made available for the success of the project. The coercive organisational practices enacted by the ITA and the MoH were evident during the implementation of the e-Health portal.

The ITA's vision of helping government agencies in developing their systems was made clear by the introduction of ***centralising policies*** to which government agencies, including the MoH, were forced to comply. One of the senior managers in the ITA emphasised:

> '*Our role was to help the government agencies to develop and design their ICT roadmaps, defiantly when it comes to the infrastructure, the G-Cloud was one of the components that I had to consider, so my task is trying to help each government agency to do the transformation; in other words, we want to convert all the manual processes to digital ones' ITA01, 11/11/2015.*

The ITA's centralised policies on converting manual processes into digital ones were a major factor in building the e-Health portal and hosting it in the G-Cloud. The ITA forced the MoH to use the central infrastructure of the G-Cloud to develop its e-Health portal through different means.

Stakeholder power also played a major role in the adoption and implementation of the G-Cloud. The senior managers in the ITA were able to influence the senior IT managers of the MoH with their vision of a centralised government infrastructure, which helped the implementation of G-Cloud. Since the ITA was the main agency regulating and supporting government IT projects, it wielded indirect Stakeholder power over the other government agencies. One of the MoH's IT managers stated that

> '*The decision was made by the senior manager in the IT department and the senior manager of the ITA to join the G-Cloud, and the G-Cloud team in the ITA and the member of the evaluation team in the e-tender evaluated which company would do the implementation of the e-Health portal along with hosting it in the G-Cloud' MOH02, 29/07/2015*.

This Stakeholder power was also the reason why many members of the MoH's IT staff were not involved in the decision-making. As another IT manager in the MoH said,

> *'Honestly, I am not involved in why they have decided to go with G-Cloud, I am only concerned with the part after they have decided' MOH04, 09/08/2015.*

This was also highlighted by another manager, who stated,

> '*Well, the project started, I think, one year back; the study, of course, was before that. The senior manager of IT, his team, following the committee which was formed by the undersecretary. They did a thorough study and came up with recommendations. After that, the project was initiated' MOH06, 23/08/2015.*

The decisions made by the ***top level*** to implement the G-Cloud and to accept the solution that included all the standards caused challenges to be raised by various technical departments and users during the later stages of implementation.

Although the ITA did not have the direct legal authority to impose its standards over those of the MoH, it did wield indirect influence through various means. First, one of the ITA's objectives was to speed up the technological implementation process in all government agencies. Second, the ITA supported the project with its financial resources and skilled personnel. This was one of the main reasons behind the MoH's decision to join the G-Cloud. A senior IT manager in the MoH stated,

> '*Well after we had distributed the tender of e-Health project, the G-Cloud was not in the picture at all. After that, we knew that the ITA started to build the G-Cloud. We again asked the vendors to provide us with the financial cost if we move to G-Cloud and how much will it cost us. We found out that the G-Cloud is much better financially*' MOH01, 29/07/2015.

Another MoH IT manager also added that:

> '*Joining the G-Cloud was mainly to save cost on the hardware. It was the time we were finalising the tender, and then the ITA was offering this solution, and it was offered for free' MOH02, 29/07/2015.*

Moreover, the ITA provided the MoH not only with the G-Cloud but also with full support for the e-Health portal. One vendor staff member involved in the e-Health portal clearly stated how the ITA wielded ***financial power*** over this project. He said that

> *'The ITA is the customer who pays us, the Ministry of Health is the end user for us because they are the one who tells us what to do and the ICT health which is the prime contractor' MOH08, 23/08/2015.*

Its financial power over the MoH enabled the ITA to impose its standards from a higher level. The ITA's control over the finances can be interpreted as a coercive power as the MoH would not have had the resources to execute or build the e-Health portal.

Financial resources were not the only leverage suited to apply pressure into joining the G-Cloud. Human resources that were provided as ***Management Control*** with the G-Cloud were also a major factor in influencing how the e-Health portal would be implemented in the G-Cloud. Accepting to join the G-Cloud meant that the MoH information infrastructure would be managed and controlled by a professional government agency that had the human resources capable of managing different information infrastructure areas such as network and security. One of the ITA's Project managers clarified this by saying:

> *'If I am in the G-Cloud, I am free of my responsibility... It will be the responsibility of the G-Cloud team to set the G-Cloud environment to set up for the ministry; then the vendor was given access. So for me, as a Ministry, I do not have to worry about it. The second scenario, which is hosting in the Ministry… I have to deploy a Ministry IT team, which I think does not have the capabilities to do that. So, we are freeing the MOH from HR requirements also' ITA07, 30/11/2015.*

During the implementation of the e-Health project, the standards set by the ITA for all government agencies to join the G-Cloud faced challenges. These standards could be considered the ***rules and regulations*** to which any government agencies that wanted to join the G-Cloud would have to comply. The e-Health project was the first one for the G-Cloud to host an application from an external government agency. As such, it was a learning curve for both the ITA and MoH teams, as they faced many new and unexpected challenges. From the early implementation period, the e-Health's vendor used an agile

methodology approach. This meant that some e-Health modules could be activated as soon as they were completed, with no need to wait for the whole portal to be ready. The e-Health team's ***client requirements*** pressured the G-Cloud team as they were forced to have the G-Cloud ready for the e-Health portal. A vendor staff member also stated:

> *'To solve our requirement; the ITA came up with the concept called the mini-cloud. So, while the ITA was doing the proper cloud project on the side, they did a mini-cloud for the MoH to cater for our requirement' MOH08, 23/08/2015.*

Therefore, the pressure was mutual at this stage of implementation, with the MoH client requirements being imposed on the ITA resulting in the introduction of a Mini-Cloud solution suited to the agile method adopted by the MoH team and its vendor. At the same time, the ITA imposed its rules and regulations.

As the implementation stages progressed, the ITA team started introducing more standards to be applied to the e-Health portal. Some of these had been clearly communicated to the MoH team through different means—such as documents—while others, such as ***security standards***, were introduced later. These standards created implementation challenges for the e-portal team but did not stop the project from progressing. The MoH is a large government agency with over 240 sites all over Oman, and many of its IT staff members held the privileges needed to make changes to their application. Once the e-Health portal was hosted in the G-Cloud, making local changes was no longer possible. One of the MoH's managers stated that:

> *'The ITA wanted to impose their standards on our system, especially the security standards. For example, they had many concerns, and we asked them to give us many exceptions. … almost every action we took, nearly every click returned an error from the ITA, because they had to analyse all the traffic to make sure it was not an attack, so they had to make an exception on their system to make it pass' MOH02, 29/07/2015.*

Moreover, the MoH was the first who implemented several security standards. The ITA's project manager for the MoH added:

> '*All the policies that were prescribed by the ITA were put there. It was first as to have everything to be as per Public Key Infrastructure (PKI), and Mobile PKI for users who wanted to get access the username and password. We were the first*

> *who implemented the integration with MOC (Ministry of Commerce) and integration with ROP (Royal Oman Police) for all the G-to-B services through the ITA integration platform. We were also the first who used the cyber sources e-payment and so many things we used to do for the first time*' ITA07, 30/11/2015.

Although some of these standards, such as the PKI, were hard to implement, the MoH agreed to them because of ***top-down*** pressure from the ITA, and because it believed it would benefit from them in the long run. The ITA project specialist for the MoH also added:

> '*We understand this has to be a hard effort and it might affect the usability of the portal, but then we had a long discussion, me and the DG of IT, and myself and the vendor, if we provide a temporary access for 3-6 months, along with the PKI, human mentality will never go for PKI later, so we thought about it and we preferred to start from the start and mitigate that risk as PKI team'* ITA07, 30/11/2015.

The portal administrators expressed their concerns over the PKI and how this would affect the future use of the system. They stated that:

> *'To get access to the system, for us to access the e-Health portal requires that the National ID card must be updated, as the old cards issued before 07-2014 will not work, so they have to go to the Civil Status Office to get a new card and, after that, they have to go to kiosk machine to authenticate the card and, on top of that, they need to have a card reader in order to read the card to access the portal. Many feel this, by itself, to be very challenging, which makes many users think many times before accessing the system' MOH03, 09/08/2015.*

Although the security standards were a concern for some, as they could affect implementation and usability, the MoH's senior IT manager was convinced that implementing a large health portal required such strict standards. He explained:

> '*We made our study to look at the advantages and disadvantages of moving to the G-Cloud. I will not hesitate to say that we have a lack of security in the MoH. We saw the security benefit in the ITA G-Cloud, and we felt it is better to be there … Yes, they did push us to their standard, which, I think, is beneficial to us. One of*

them is the security standard; everything is checked; we cannot move unless we pass their security checks' MOH01, 29/07/2015.

A manager in the MoH's IT department explained how the security standard was restricted and hard to execute. She explained:

'When it comes to standards, it is mainly the security standards. For example, they are putting security devices on each entity that is connected, and this is taking time. They are providing these devices for us. After discussions with them and convincing them that this will take a long time to implement to all, they have given us alternative option to make the system run which they are working on, but they expect us to put all these devices in the future' MOH02, 29/07/2015.

Moreover, the MoH had to comply with the ITA's ***rules and regulations*** when it came to where to host its application. Another IT manager of the MoH explained:

'*I think there are instructions from the ITA that any portal has to be hosted inside Oman, not outside the country. It has to be hosted in the G-Cloud, or it must be hosted internally. I consider it to be dangerous if it is not hosted internally inside Oman. I cannot imagine seeing my data to be managed or hosted by a cloud company outside Oman or by a private corporation. So it is fine as it now, hosted by the ITA G-Cloud, as they have secured MPLS' MOH04, 09/08/2015*.

While the G-Cloud was imposed ***top-down*** on the MoH staff, some employees still thought that to have everything within the boundaries would have been better for management and flexibility purposes. One of the IT managers in the MoH explained:

'*It would have been easier if we had the qualified people, and unless the vendor managed the full hardware. My opinion is to have everything with our boundaries. It will give me the flexibilities to manage it and control it' MOH02, 29/07/2015*.

A senior manager in the IT department explained the reasons why some MoH staff members would have preferred the G-Cloud to be hosted internally by saying:

'the G-Cloud is new, there are many breakdowns at the beginning, the break is there because of maintenance and upgrades until they get used to it and stabilised it, but since the last update, we are not having lots of problems' MOH01, 29/07/2015.

Others also believed that, despite the early issues with the G-Cloud, it would still be better to host the MoH portal in the G-Cloud, as opposed to the MOH's own Data Centre. Performance, security standards, integration, and reliability were some of the advantages highlighted by the stakeholders of the e-Health portal. The vendor's project manager explained:

> *'I would do the project again; I would do exactly the same. As I have known the G-Cloud's benefits' MOH08, 23/08/2015*.

As the implementation of the e-Health progressed, the G-Cloud project was also progressing. The G-Cloud team introduced some standards and controls to the e-Health portal. Some of these standards were mutually agreed upon, while others were introduced during later stages. One of these standards was the Public Key Infrastructure (PKI). The PKI had been part of the e-Health portal's implementation. However, there were two arguments on the implementation of the PKI in the e-Health portal. Some of the staff members believed that the PKI would make the transaction much more secure in practice, with the introduction of many services online, which had not previously been the case. Others believed that the PKI would reduce the risk of the system being hacked. Others still believed that the PKI would make accessing the portal much more complicated. The users would first need to go to the Civil Status office to renew their ID cards, and then they would have to go to one of the few kiosk machines to activate them and create passwords for them either through ID card or mobile access; finally, they would have been able to access the system. The PKI was mandatory for all developers, system administrators, and users. For some developers and administrators, it was inconvenient to have to use their ID cards and card readers every time they needed to access the system. They thought that, if the PKI was complicated for them, it would prove to be much more complicated for internal and public users.

Another issue was also highlighted by developers and administrators. The ITA's Information Security Division (ISD) had imposed restrictions on them in order for all government agencies to be ***compliant*** with security standards. If they wanted to update and make any changes to the system, they would have to do it through a single dedicated machine in the MoH. This was initially not accepted due to the limitations it imposed, but the top management forced the technical team to agree in order to allow the project to continue. Another issue that was raised was that, once the e-Health portal had been moved

from the Mini-cloud to the actual G-Cloud, the web pages did not open or did not work properly. No one knew the reason for this, and the technical team thought it was an internal issue. Eventually, it was discovered that it was because of the restrictions that have been imposed by the ITA's security team. These problems continued for a while and were very time wasting. Therefore, the G-Cloud team decided to create a G-Cloud helpdesk to enable any requests and complaints to be dealt with systematically. This helped resolve the issue faster. At this stage, the slow response had become a concern for the MoH's IT management in regard to how the G-Cloud team would be able to cope with future client volumes, which they expected to reach 20 government agencies within two years.

These concerns notwithstanding, the management still believed that any issues and concerns identified in the implementation of G-Cloud would have been much worse if the e-Health portal had been hosted internally. They believed that the ITA had a professional security team that could prevent any future security risks. Also, advantages such as performance, reliability, future integration with other government entities, and cost were much more attractive than hosting the portal on their premises. Therefore, whatever the challenges highlighted by the staff in relation to the G-Cloud's implementation, the management pushed to solve the issues and ensure that the portal would run on it.

The role played by coercive isomorphic mechanisms in leading to the standardisation of the information infrastructure system through the implementation of the G-Cloud is apparent in the case of the e-Health portal. The analysis shows that, both in the pre-implementation and in the early implementation stages, the standardisation of the G-Cloud was not contested. However, during the implementation, mutual pressures were applied: top-down isomorphic pressure by the ITA, and bottom-up non-isomorphic pressure by the MoH. These resulted in delays in the implementation of G-Cloud standards. In the final stages of the e-Health portal's implementation in the G-Cloud, the ITA's pressure led to the successful implementation of the standards that came with the G-Cloud.

6.4.2. Mimetic Institutional force

Mimetic mechanisms played a major role in the standardisation of the e-Health portal, as some practices appeared from its implementation. The MoH staff in had heard about the concept of cloud computing and of how this solution would solve infrastructure challenges. This was ***market rhetoric,*** with all vendors and other government agencies talking about it. The cloud computing solution was considered to be a ***new trend*** by the MoH staff, and they were interested in trying it as an alternative solution to solve their information infrastructure challenges and to host the e-Health portal. For example, the project manager of the e-Health portal described the G-Cloud as:

> *'In general, what I understand, it is a new trend in hosting government network, it a good place for security and more space and freedom of having as much data as you want without any concerns and of course cutting cost on physical hardware' MOH02, 29/07/2015.*

The MOH's network manager also confirmed this by saying:

> *'I believe the whole world is going to the cloud' MOH04, 09/08/2015*.

Other MoH employees looked at ***successful countries*** that had implemented cloud computing and considered them to be good examples to follow. They considered this to be a legitimate reason to be part of the G-Cloud. The e-Health portal management team elaborated on that by saying:

> '*If you look at other countries' experience, you will find that they have one portal for the whole government, and the G-Cloud would help in this one portal' MOH03, 09/08/2015.*

These statements can also be interpreted as endorsing a relevant ***best practice*** by looking at other countries—in this case, Estonia—when deciding to join the G-Cloud.

Another mimetic practice saw the MoH being presented as a ***role model*** for other government agencies who were interested in joining the G-Cloud. The DG of IT states:

> '*Also, the ITA wants the health portal to be a good showcase for them, and they are trying hard to give us the best service. Also, their security standards are very high, and they have the advantage over others' MOH01, 29/07/2015*.

Mimetic isomorphic mechanisms playing a role in leading to the standardisation of information infrastructure system through the G-Cloud is also clear in the implementation and standardisation of the MoH's e-Health portal. The analysis shows that all the practices mentioned above enabled the MoH to model itself on similar organisations within Oman or even abroad, to consider themselves to be more legitimate or successful.

6.4.3. Normative Institutional force

The normative institutional force also influenced the implementation of standards for the e-Health portal in the G-Cloud. Both the ITA and MoH teams had the required technical ***professionalism*** and ***IT knowledge***. This resulted in the agreement that the implementation of an infrastructure technology such as cloud computing would be beneficial for government agencies such as the MoH. However, during the implementation, the normative pressure derived from the MoH's knowledge helped it to contest many standards introduced by the ITA.

Several normative mechanisms influenced the standardisation of the e-Health portal. One of these stemmed from the ***general knowledge*** of the team who managed and implemented the e-Health portal. One of the MoH's IT managers stated:

> *'I know the G-Cloud can provide you with high availability and can have an endless amount of space' MOH02, 29/07/2015*.

A senior manager in the MoH also adds that:

> *'The ITA held several seminars, and they invited us. We understand it, and we encourage it' MOH05, 11/08/2015.*

However, those IT staff members who were not involved in the decision to join the G-Cloud did not have sufficient knowledge of its benefits. For example, a MoH technical manager said that:

> *'I honestly don't know the details of its functionalities. They did make a presentation about the G-Cloud, I did not attend' MOH04, 09/08/2015.*

Such limited knowledge contributed to the implementation challenges; however, the vendor project manager, who was heavily involved in the implementation, stated that, in one case, some knowledge was necessary by declaring:

> '*it was a learning curve, it was more of the staging environment, and we fixed it, they would not replicate these rules into production, so we told them whenever you list something on the staging or production, you have to synchronize both servers' MOH08. 23/08/2015*.

Although there were differing views on the G-Cloud, all the e-Health team members agreed that the G-Cloud had given them better implementation flexibility.

Although professionals from departments such as networking and security had their concerns over the G-Cloud's implementation, these did not have any effect on standardisation as a control for infrastructure support had moved to the G-Cloud team. The senior manager of IT stressed that:

> *'The human resources in term of infrastructure are much better in the G-Cloud team than in the Ministry of Health. So we negotiated with the ITA to host our system there, and they were very welcoming for us to move, and we decided to move' MOH01, 29/07/2015.*

The G-Cloud team's knowledge and professionalism helped the MoH management to trust them as they believed that the local MoH team did not have the skills needed to manage a large infrastructure for the MoH e-Health portal. This trust enabled G-Cloud standards to be implemented in the e-Health portal.

Another normative practice that contributed to the MoH e-portal's standardisation was the **training** of IT staff in managing the G-Cloud. As a senior IT manager explained:

> *'The ITA provided us with a workshop on how to implement and how to configure the system and how to host the system. Since we are the only organisation and they are helping us as much as we can, we feel we are lucky' MOH01, 29/07/2015.*

On the other hand, other employees still believed that this training was insufficient and that more was required to make the staff more comfortable. A MoH Manager asserted more on training by stating:

> ‘Our *team would definitely need more training on cloud computing, starting with me. I do not think it is straightforward. I do not see the full picture as I am not technically involved and should be; so, next time, when we want to implement a new project in the G-Cloud, we should know what our capabilities are and what we are supposed to have and what are our limits. The vendor will not always be there. So training is necessary’ MOH02, 29/07/2015.*

The team who were managing the e-Health portal also agreed by stating:

> ‘*We are managing the portal, and we feel that we will be asked about this technology and, if you say ‘I do not know about it’, it will be hard for the users. We need to know all detail’.*

Moreover, the Network director added:

> *‘Training is essential, particularly when it comes to the staff who are directly involved in cloud implementation. Now we do not have any training in the G-Cloud. Training is important, and we are part of the government, and the G-Cloud is part of the e-government network, and it is good to understand how it runs’ MOH03, 09/08/2015.*

A technical staff member who was managing the G-Cloud interface did get some training but also requested more, as he stressed by saying:

> *‘I believe training is very important. There are certain people who need good training. For example, I do need more training in operating the G-Cloud. It is true that it did not take me that long to understand it. However, the overall training is essential’. MoH07, 11/08/2015*

Another manager disagreed with all by highlighting that the G-Cloud was an infrastructure and training was only needed for selected staff. He explains:

> ‘*For the G-Cloud, I do not think all people would need to be trained. In MOH health, one of the technical staff was selected to create and manage these servers which their G-Cloud portal where they can go and create the new server and manage them and add and delete. That is something which they needed to train someone, and they did, but others don’t need to be trained’ MOH07, 11/08/2015.*

Various normative mechanisms in the MoH's implementation stage resulted in the standardisation of the e-Health portal. The MoH staff and vendor's general knowledge enabled them to contest the implementation process, request a Mini-cloud, and overcome some security standard issues in the initial stages of the implementation. Although training was demanded by some IT staff, it did not have any influence over the standardisation of the portal as there was no need to train all the IT staff.

While these practices resulted in the implementation of standards in government agencies, other normative practices were considered to be against the standardisation or practices by the professionals to contest or reject the G-Cloud. For example, some of the professionals did not take ownership of the G-Cloud as the infrastructure for their system. This was made clear by one of the IT managers, who said:

> *'Honestly, I am not involved in why they have decided to go with G-Cloud, I am only concerned with the part after they have decided' MOH04, 09/08/2015.*

A project specialist also raised his concerns about the usability of the PKI system, which is an embedded standard throughout the G-Cloud in the MoH portal, by saying:

> '*We understand this has to be a hard effort and it might affect the usability of the portal, but then we had a long discussion, me and the DG of IT,* so *we thought about it, and we preferred to start from the beginning and mitigate that risk as a PKI team'* ITA07, 30/11/2015.

In the case of the e-Health portal implementation, normative practices had two different outcomes. First, organisational practices, such as the manager's general knowledge and some of the technicians' lack of understanding of the G-Cloud, which contributed to its standardisation. Second, other organisational practices, such as technical professionals resisting the requirement and standardisation of the e-portal. The above analysis shows that, while some organisational practices helped standardisation, others hindered it but did not result in the delay of the launching of e-Health portal.

6.4.4. Summary of practice for the MoH e-Health portal

This section summarises the MoH's implementation practices that led to the standardisation of the e-Health portal. Centralised policies, stakeholder power, financial

resources, human resources, rules and regulations, client requirements, security standards, top-down, and compliance with organisational practices all contributed to create coercive institutional force. Professionalism, knowledge, and training contributed to build normative institutional force. Market rhetoric, new trend, successful countries, best practice, and role model practices contributed to apply mimetic institutional force. Figure 6.4 summarises all the practices that influenced standardisation of the MoH e-Health portal in the G-Cloud project implementation.

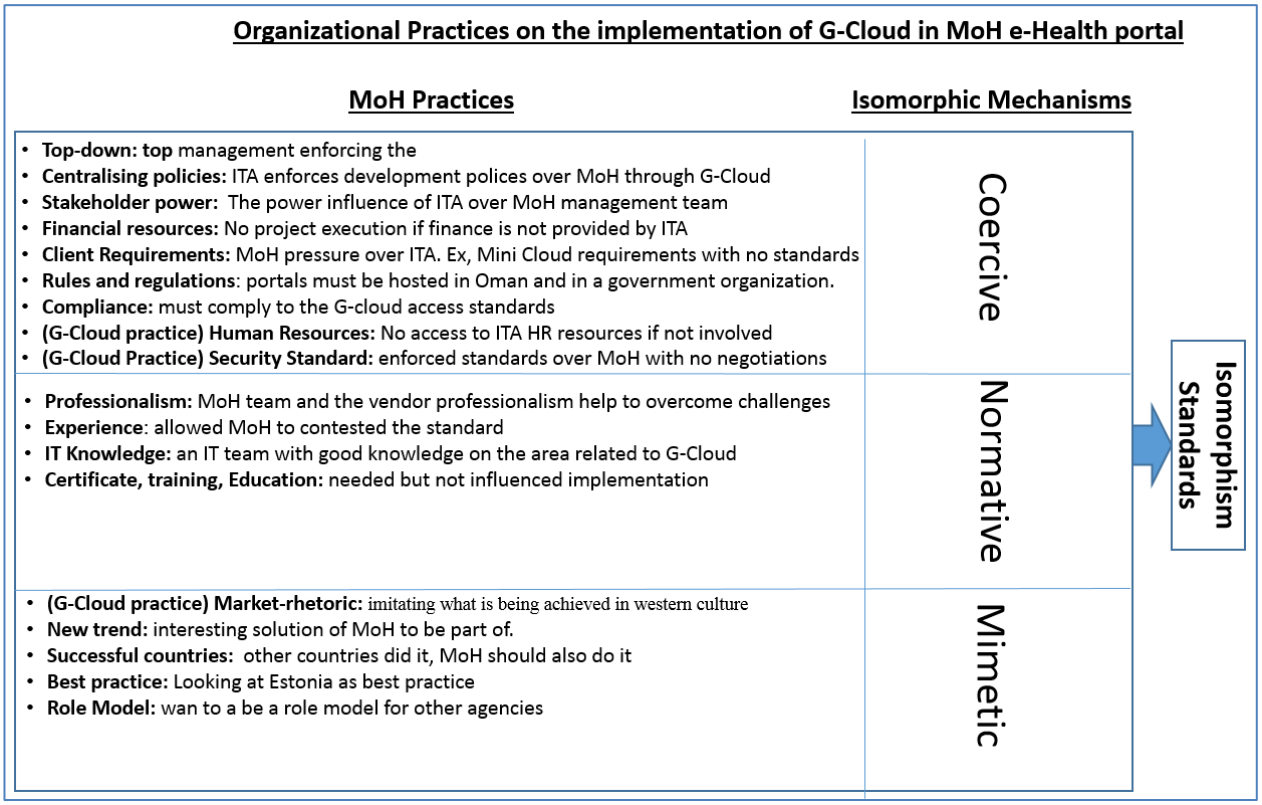

Figure 6-4: Organisational Practices on the implementation of the G-Cloud in the MoH portal

6.5. National Centre for Statistic and Information organisational practices

This section presents the various practices that led to the standardisation of the G-Cloud implementation in the NCSI. The centre's objective in joining the G-Cloud was mainly to integrate with other organisation because, as a statistical government agency, it heavily relies on other organisations' data output. The organisational practices that led to standardisation in the NCSI were noticeable in the post-implementation and

implementation stages. These organisational practices came in the form of coercive, normative, and mimetic mechanisms, as will be explained in the next three subsections.

6.5.1. Coercive Institutional force

The coercive mechanism in the implementation of the NCSI's portal contributed to the standardisation of the system. One of the practices that led to the coercive mechanism was the ***centralised policy***. The ITA set the government's policies that did not allow one government agency to integrate with another if its application was hosted by a nongovernmental agency or abroad. The ITA considered security as a priority and took every precaution to prevent any future attacks to or security breaches in government agencies. Therefore, it took the extra precaution of mandating that government agencies should host their online services and IT systems with a local government organisation. The motivation to join the G-Cloud arose when the NCSI wanted to integrate with other government entities such as the Royal Oman Police. Those entities refused the proposed integration because the NCSI's portals were hosted in a public cloud, and were not using the Oman government's MPLS (Multi-Protocol Label Switching) private network. When the NCSI approached the ITA for MPLS line connection to the portal, it refused since the Oman Data Park was a private company. Fortunately, the G-Cloud project had started offering its services to government agencies, so the only option available to the NCSI was to move there and solve its integration issues. Therefore, the main driving force for joining the G-Cloud was the need to integrate with other government entities. Other motivations existed, such as privacy and data sharing. The IT expert in the NCSI confirmed this by saying:

> *'For us, we are mainly going for integration purposes, and soon we will get the fibre line which will help us much better, even we can take all our storage there' NCSI02, 01/10/2015.*

A manager in the NCSI's IT department agreed with the previous statement and explained that, although integration was the main objective, it was also understood that the G-Cloud came with security standards. He says:

> *'I fully respect, and I fully support the regulation of ITA, where they say we are not going to share the MPLS and OGN (Oman Government Network) with the*

> *private sector, which I think it is a good decision, this is my opinion*' NCSI01, 01/10/2015.

Although the centralised policy of integration forced the NCSI to join the G-Cloud and accept its standards, national or government agency ***rules and regulations*** also made it necessary to move to the G-Cloud. Another IT department manager explained how the G-Cloud could help them overcome the bureaucracy of having to pay the staff overtime to manage the infrastructure,

> *'The driving force that you cannot host here is the regulation of the country, for example, you cannot allow someone to work 24/7 as you cannot provide overtime for them, so there are some limitations there which also make you not host here'NCSI01, 01/10/2015.*

These roles and regulation also caused the NCSI to accept the standards that the ITA had imposed on government agencies, which had been hard to implement in previous times.

Another significant incentive to join the G-Cloud was provided by the ***organisation's structure***. The presence of the ITA's CEO as a board member of the NCSI influenced the latter's decision to join the G-Cloud. The G-Cloud was an ITA project, and it needed to ensure that a good number of government agencies was joining it in its early stages. The role of the ITA was to promote IS in government by introducing various initiatives; the G-Cloud was one such initiative of which the ITA's CEO convinced the NCSI, as one of its stockholders, to be a part. An NCSI manager explained how the CEO influenced the decision by saying:

> '*The ITA CEO had influence as he kept pushing in every meeting that we already had a G-Cloud so why you want to host your application internally and why you want to pay for hosting outside … he always says we did the G-Cloud for governments, so we wanted to try the G-Cloud, and it will not be an excuse for future if we did not join for another project' NCSI04, 17/11/2015.*

As the decision to join the G-Cloud had been discussed at the top-level, it had been mediated by a ***top-down*** practice, in which the top management influenced the decision. When asked whether they had been consulted to join the G-Cloud, an NCSI manager explained:

> *'Well there was no consultation with anybody, they just released the project, and then they told us to join' NCSI03, 17/11/2015.*

As many NCSI staff members stated, the cost factor was another driving force in joining the cloud. All government agencies had been mandated by the Council of Ministers Office to cut costs and find better and more cost-efficient alternatives without affecting the work. Many of the decisions made by government agencies were ***financially*** driven. Many government agencies were obligated to go with the introduction of the G-Cloud solution; otherwise, they would have had to convince their senior managers to adopt an alternative solution that would have probably cost more than the G-Cloud offering. The ITA's proposal to the NCSI team involved providing the G-Cloud infrastructure free of charge for its statistical portal. The solution was financially attractive, and the ITA used its authority to constrain the government agencies over the financial budget, so the G-Cloud solution became the best alternative as it was the more financially attractive. An NCSI manager explained:

> '*By joining the G-Cloud, I am reducing my overhead, my operating expenses and capital expenditure' NCSI01, 01/10/2015.*

This was confirmed by a technical expert, who explained how the NCSI could save by joining the G-Cloud and also how implementing shared services on it would cost all government agencies less. He added:

> '*If you see the return on investment, so many projects were done for the goodwill of the people, just to provide the facility for them. I do not think we can just map how much we can save on this, but for the expenditure point of view, we will be saving a lot. This can be shared infrastructure and maintained by government people. For example, the single load balancer I buy, I can use that for ten applications, but despite that, I need the load balancer. For G-Cloud, I can fully utilise this load balancer' NCSI02, 01/10/2015*.

This clearly highlights the ***financial force*** that the ITA applied to the NCSI for it to join the G-Cloud. In the case of the NCSI, the financial forces took the shape of informal pressure being applied for them to join the G-Cloud.

Once the implementation started, the NCSI team realised that they would have to follow a number of ***standards*** for their portal to be launched through the G-Cloud. To administer

its portal hosted in the G-Cloud, the NCSI team would need to be authenticated in compliance with G-Cloud standards and procedures. The PKI was embedded in the NCSI installation, which created challenges during installation, but direct communication with the ITA vendor helped the team to solve the issue. The PKI restricted NCSI to using ITA standards for its users to access the portal.

Although providing the virtual space for the Data Portal was easy, the migration of the portal from the ODP to the G-Cloud was not as smooth. For example, the NCSI's IT team thought that all that would be needed would be making an image copy of the existing portal and migrating it to the G-Cloud. They found that making such a copy was not an easy task; thus, the migration process would be more complicated than they had expected. For example, they would have to install the OS—Windows—then rebuild the portal on top of it, as OpenStack was not compatible with VMware. Therefore, the NCSI team asked its vendor for help in moving the portal. One of the IT directors explained this issue:

> '*When you are running on VMware, you have several VMs servers, running on a single host. If you want one server of these, for example, the application server, we just take a full replica of the full WMR, and we populate it on other VMware. It will then be up without any error, we thought the same idea would apply here, we took one full VMDK, we gave it to them so they could populate it with them, and it would be up and running. However, they then said that OpenStack was not compatible. However, I would not consider it is a big issue, but it would create for me another cost as I would have to bring in someone to do the installation configuration and other things' NCSI01, 01/10/2016.*

The IT manager also compared his case to how the process would run smoothly when taking a copy from the ODP:

> *'Locally, I have a virtual environment running in the Data Centre, and I can take a VMDK from Oman Data Park, it will only take me one day to configure that. So I imagine that this should be easy, but anyway, they are trying to avoid an issue might happen in the future' NCSI01, 01/10/2015.*

This issue prompted the NCSI's IT team to make a comparison between the services they got from the ODP and the G-Cloud. They noticed that the ODP's services were more organised as it was a private company that had been in the market for a while. Conversely,

a government organisation ran the G-Cloud as a new project. Therefore, the customer service experience was still not mature.

Another issue that was highlighted pertained to ***imposing Security controls*** over the G-Cloud clients in relation to access limitations within the country. For example, the NCSI team needed its vendor to access the system remotely from outside Oman to contain travel and accommodation costs. Now they would have to pay for those as they moved to the G-Cloud. An NCSI IT manager explains:

> *'They are not allowing the remote access outside the government; because, as I told you, we have some vendor outside Oman, now we cannot grant access to them, I respect their decision. … Moving to the G-Cloud will create for me another cost. For example, I have this vendor who accesses remotely, now I have to bring him, and I have to pay him also, now he says he will come, but he needs tickets and accommodation because he has to access the infrastructure from my internal system' NCSI01, 01/10/2016.*

The NCSI team also had other requirements that could not be met at that stage of the G-Cloud's implementation. As it published significant amounts of data, sizing was important to the NCSI; however, the G-Cloud team resisted providing any large space unless it was objectively justified. Also, the NCSI team wanted to have a sizeable dedicated leased line for the public to access its data, but this option was not available as the leased line was to be shared among all cloud users. This service had not been available even through the ODP, but the NCSI team had expected this to be an option in the G-Cloud. The NCSI's IT expert believed that more controls and restrictions could be requested in the future, should more sensitive data be moved to the G-Cloud. He explained:

> *'Now we have the raw data in our Datacentre, but we are not putting this in the G-Cloud now for privacy reasons. When are going to raw data, then we are definitely asking for more privacy requirements. So the portal now does not demand any particular requirements, but when it demands, then we ask for our requirements' NCSI02, 01/10/2015*.

The NCSI team were also taking their time for the full migration as, at the time, they had the ODP option available. They wanted to make sure that everything was settled before

going live, particularity when it came to the issue of the PKI. The PKI access was a concern to the NCSI team, as was raised by an IT expert:

> *'Even the PKI access has an issue. Just to verify my access, it took me a while to find a Kiosk machine, and it is a bit complicated, and the registration in Al Meera Shop and the process is changed, even some people stopped by and ask me what this machine is about. Then, I went to Zakher shopping mall. Moreover, then finally, it went to UNA (eOman portal access) portal, not with the PKI. … We need to know what kind of exercise they have done for big projects. The people will not be registered if you will not change the current way. I think it is better to use other means because the Kiosk is a great Chaos' NCSI02, 01/10/2015.*

The issue of who controlled what had not also been clearly defined, which caused the ITA to request that the vendor implement many controls and standards at different implementation stages. These controls and standards were also imposed on the government agencies, including the NCSI, at various stages of the implementation. The G-Cloud vendor's system architecture explained the government agencies' perspective on how the G-Cloud would run:

> *'One of the main challenges is the new approach, people are coming from the ministries with a mindset that they have full control of the thing, and then ITA is just doing something, this is not something realistic. If ITA offers infrastructure and ITA offer services. Essentially, ITA offers and controls that. Sometimes it is very hard for customers to understand that because there are requirements like onsite visit and who control the data, which cannot be technically feasible, it is a more traditional way of thinking, so learning or negotiating things takes time' ITA09, 30/11/2015.*

The discussions above highlight how coercive pressure contributed to the standardisation of the NCSI portal in the G-Cloud. That pressure took the shape of central financial funding and of the rules and regulations that were imposed on the NCSI to accept the standards; these were contested during the implementation of the NCSI portal in the G-Cloud but were eventually accepted.

6.5.2. Mimetic Institutional force

Several mimetic practices persuaded the NCIS to accept the standards that came with the implementation of the G-Cloud.

The NCSI team acknowledged the need for an infrastructure that was capable of handling its expanding portal. The G-Cloud provided the team with an opportunity to satisfy that need. However, the team was unsure of whether the G-Cloud would be able to handle the NCSI portal and whether cloud computing, as a concept, could be successfully implemented in government agencies. The team asked the vendor whether adopting the G-Cloud as an infrastructure for the NCSI portal would be a good idea and whether there was a ***role model*** that the NCSI could look at to aid the decision process and avoid the ***uncertainties***. Therefore, ***best practice*** was one of the motives to join the G-Cloud as it was recommended by a vendor who had developed the portal. A senior NCSI IT manager highlighted,

> *'The vendor, since they are from the advanced country and probably since they are recommending the G-Cloud infrastructure, so I think that their design or their basic design was based on a cloud computing concept. That is why they are saying they will get better performance, or that the issue of performance we are having, internet on the normal infrastructures; will disappear when we move to the Cloud. I believe they are right, as they have given a sample for us, maybe they are better, why not try to move' NCSI03, 17/11/2015.*

Moreover, the NCSI had been recently established and tended to adopt the best administrative, technical and statistical practices from global or local organisations to gain legitimacy within society. The team sought to find ***successful organisations*** and mimic their practices. The team knew that other government agencies were implementing their systems in the G-Cloud, which comforted it in making a similar decision. A senior manager in IT elaborated:

> '*There are two reasons. First, we do not want to be left behind and, nowadays, most system and application development vendors are basing their design on the cloud. Also, we do not want to be that last entity to move to the G-Cloud, we prefer to be the first and gain experience from the G-Cloud' NCSI03, 17/10/2015.*

Another IT manager explained how they had considered the MoH as a successful organisation and wanted to mimic their success by saying:

> *'We looked at the MoH as a best practice, and we wanted to know their experience. First, he said you would suffer, but then it will be fine' NCSI, 01/10/2015.*

Therefore, the NCSI team acknowledged the standardisation of the G-Cloud as it considered it to be a best practice. Also, the implementation of the G-Cloud by other government agencies motivated the NCSI team to accept the G-Cloud standards. The above findings show how the mimetic institutional force in organisational practices had contributed to the standardisation of the NCSI e-portal.

6.5.3. Normative Institutional force

The normative institutional forces that led to the standardisation of the NCSI portal project were also introduced through various practices. The IT team criticised the ITA for not communicating better with its ***IT professionals*** who could have helped to promote the G-Cloud within the NCSI. They believed that the knowledge that they could have obtained prior to the implementation would have helped them to understand the process and thus make the G-Cloud concept easier to adopt. One of the NCSI's IT managers in NCSI explained:

> 'We *have not been consulted about this project; they have not even invited us, one of the shortcomings that I want to say that the ITA is not promoting things properly, they do a good job overall, but they need to communicate with us probably, they come here, they should explain to us what PKI is, most of the people don't know, I feel they should embrace the IT people, I mean the IT Directorate in each entity, especially the entities who are active in IT, like us and MM' NCSI01, 01/10/2015.*

The project management ***experience*** that the NCSI team had accumulated enabled them to know what the G-Cloud needed to achieve successful implementation. As the G-Cloud was a new project, the ITA team did not have experience of what might be required. The IT expert explained:

> ‘*Maybe for small entities; it is nice to explain it to them; we know what cloud computing is. We should have a checklist of what is required to go for cloud computing. So that means gives clarity for the client, so he is prepared’ NCSI02, 01/10/2015*.

Although the IT professionals emphasised the ***lack of communications*** between the ITA and NCSI professionals, the NCSI staff had good ***knowledge*** of cloud computing and of how it operated. This was expressed by an NCSI senior IT manager, who stated:

> ‘*cloud computing gives you flexibility from time angles, for example, if I want to expand my data centre I have to go with so many procedures in term of hiring and buying that, calling for vendor and calling for tenders, maybe all that will shrink. So I am spending there 10 hours, now I do not have to spend these 10 hours, I only need two hours. So this is the advantage of the cloud’ NCSI03, 17/11/2015.*

This understanding was also expressed by the other NCSI staff members, who had real knowledge of how cloud computing operated and of how it would help their organisation.

Such knowledge came from the experience the IT professionals in the NCSI had accumulated, as they already had knowledge of the virtual environment that was the main concept of cloud computing. The senior IT manager explained that:

> *‘We have started the cloud before the G-Cloud, but as I told you, the vendor since they are from an advanced country and probably since they are recommending the G-Cloud infrastructure we went for it’ NCSI03, 17/11/2015.*

In relation to the NCSI’s experience in operating a Virtual Machine (VM) on its own premises, an IT expert also stated:

> *‘For the current services we have, we purchased current node cluster. Which is running more than 40 VM, if I buy this in Oman Data Park I will pay much more money. So it is better to host here, I have all the facility and have the people to manage it’ NCSI02, 01/10/2015.*

This implies that the knowledge the NCSI team had on the technology was solid as it enabled them to make better decisions while implementing their portal in the G-Cloud. Moreover, the IT expert added how he would be happier once the portal had moved completely to the G-Cloud:

> *'Actually, the tensions are less when you go with cloud computing. For example, when I was in the Eid vacation, I did not have to worry about the power outage which happens, and whether my portal is down or up when it was hosted in Oman Data Park which the same will apply in G-Cloud. If it hosted in my organisation, I am more worried about the availabilities, even if the generator is there, I worry about the diesel. So now the cloud computing teams are the one who takes care of that, and they have a better team to manage infrastructure. Now I can concentrate on my business and operation, rather than maintain my whole operation, now, at least, they will take care of 50% of my load' NCSI02, 01/10/2015*.

Another IT manager in the NCSI's IT department also explained:

> *'When it comes to the privacy of my data, I have SLA with them; I can penalise them if they lose my data. The other thing is the sharing; now we are talking about Open Data, Big Data, sharing information, so it is easy when you are in the G-Cloud to share your data when compared if you are not in the cloud. One more thing as I told you is the integration. For example, if I am here, I will get less opportunity to integrate into the cloud. This general knowledge about the Cloud and the use of G-Cloud help them to make a better decision on how to maximise the utilisation of the technology'* NCSI01, 01/10/2015.

During the implementation, the NCSI team's professionalism and experience contributed to contesting the standards within the G-Cloud. The NCSI team had a good knowledge of the Virtual Machine concept which the G-Cloud was built on. Also, its previous experience in hosting the NCSI portal in the Oman Data Park enabled them to provide their input in relation to the system. When the portal moved from the Public cloud to G-Cloud, the system had migration issues, which were also solved thanks to the NCSI team's knowledge. However, the IT team's experience was not always able to bring about change in higher-level standards—such as the PKI and VPN access—as these were considered to be one of the main components of the G-Cloud and the ITA stood firm in relation to security issues.

The findings pertaining to the organisational practices linked to normative institutional force show that the NCSI team had a good knowledge of the concept of the G-Cloud and recognised the need to be part of this national programme. The NCSI professionals

resisted some of the organisational practices but did not affect the standardisation of the system.

6.5.4. Summary of practices for the NCSI portal

This section summarises the NCSI's implementation practices that led to the standardisation of its e-portal. Centralised policies, rules and regulations, organisational structure, financial resources, Client Requirements, Standards, and control practices contributed to the coercive mechanism. Professionalism, Experience and IT knowledge contributed to the normative mechanism. Role model, best practice, and successful organisations contributed to the mimetic mechanisms. Figure 6.5 summarises all the practices that contributed to the standardisation of the NCSI's e-portal in the G-Cloud project implementation.

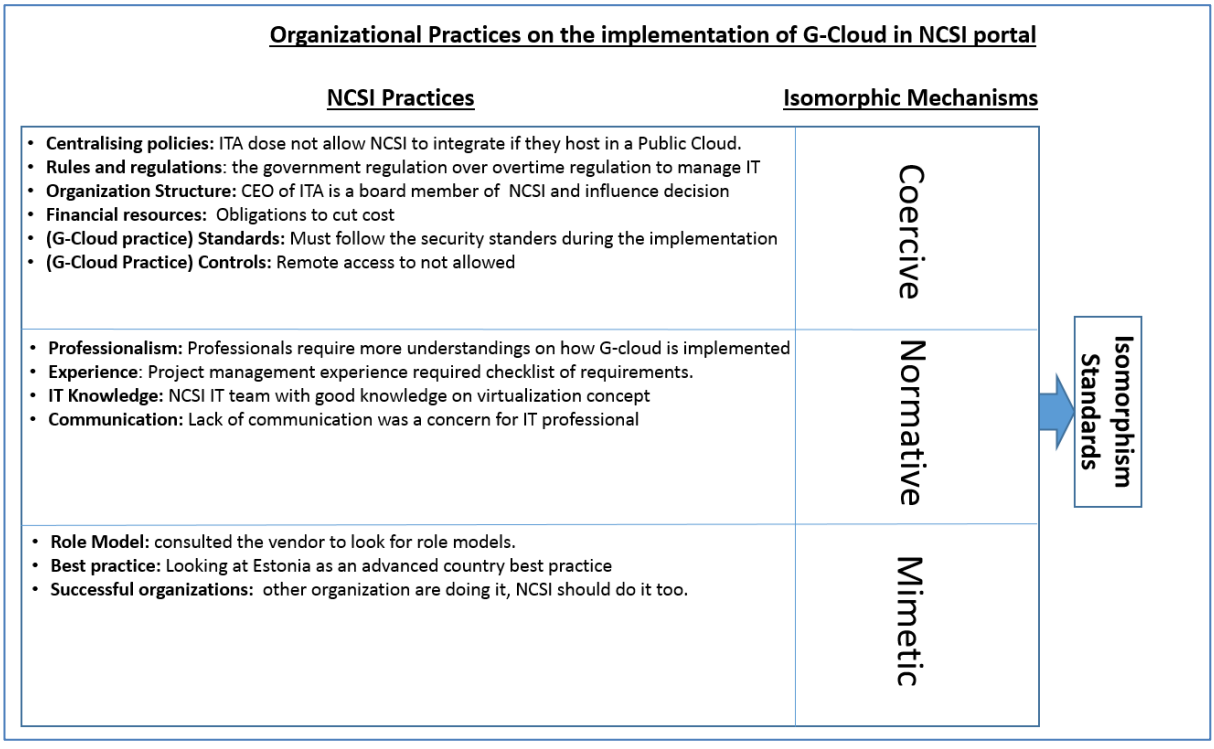

Figure 6-5: Organisational Practices affecting the implementation of the G-Cloud in the NCSI e-portal

6.6. The Public Authority for Manpower Register's NIMR Project organisational practices

During the early stages of project's development, the PAMR team's objective had been to start using the G-Cloud infrastructure immediately for the development of its NIMR project. At that point, the PAMR team had no major issues in relation to joining the G-Cloud to host their development environment. The NIMR project's stakeholders had limited knowledge of the G-Cloud. However, during the implementation, various organisational practices notably led to the standardisation of the PAMR project in the G-Cloud.

6.6.1. Coercive Institutional force

During the early stages of the project, it was clear that the ITA was pushing to implement its standards in the PAMR project; this was considered to be an important national project by the national government, which wanted a well-structured organisation capable of managing the job seeking process in Oman. Alongside the PAMR, many officials wanted to ensure that this project would succeed because of the sensitivity of society in relation to job seeking issues. With its technical and human resource capabilities, the ITA was the main sponsor of this project and influenced the PAMR through its control of the **financial resources** linked to the IT project. As mentioned earlier, several projects had been funded by ITA besides the PAMR project. The funding for this project had been made available by the Ministry of Finance through the ITA's support. Moreover, the ITA had supported the project with its **human resources**, particularly with technical ones to which the PAMR could not get access without the ITA's approval. Through its financial and human resource practices, the ITA forced the PAMR to accept its standards from the early stages of the implementation. One of the vendor's staff members explained these practices by saying:

> *'ITA consultants are working with us. They are mainly monitoring the progress, and the technical review and the requirement monitoring is done by them, let's say that the role of the consultant is being taken care by ITA' PAMR03, 27/12/2015.*

Because of the ***Stakeholder power*** provided by the Council of Ministries office to ensure that the project would be executed to the best standards, the ITA was involved in the PAMR project from the early stages. The ITA had the power to imposese its requirements and standards when making Requests for Proposals (RFPs). A senior manager in the PAMR explained:

> *'This NIMR project is conducted through the ITA, they were the consultant, part of the study, and there are basic things**,** even in the RFP, G-Cloud was part of the infrastructure RFP, and the standard was part of the proposal, ex. PKI and other standard were included' PAMR01, 01/10/2015.*

Moreover, the ITA's CEO was a board member of the PAMR and, as such, had a clear influence on PAMR decisions. All these were factors that influenced the PAMR to join the G-Cloud.

The PAMR also needed to integrate with other government agencies, so it had to comply with the ITA's ***rules and regulations***, which required government agencies to be part of an MPLS network, and the G-Cloud would greatly help the integration process. A senior IT manager in the PAMR stated:

> *'G-Cloud also encourages other organisation to collaborate with us and speed up the integration as it crucial for us. Also, since we are in G-Cloud, we do not have to talk to everyone we only have to speak to ITA … We are expecting to integrate with ten organisations for this project' PAMR01, 01/10/2015.*

The PAMR team seemed to be happy with the ITA's G-Cloud strategy and with how they were planning to run their project. A PAMR portal project member highlighted:

> *'The G-Cloud strategy should come from the G-Cloud, why they wanted to go to G-Cloud and what the benefits, they have decided it. From our side, in ten years; we want to be with G-Cloud because ITA would already have a good strategy G-Cloud' PAMR02, 01/10/2015.*

Once the PAMR had started the process of joining the G-Cloud, a concern raised by the PAMR vendor was the problem of ***control*** in the cloud. The vendor had employees in various countries who needed VPN access to the development environment. As per G-

Cloud regulation, VPN access was not allowed for any application hosted on ITA premises. This issue was a raised by a Senior IT manager, who said:

> '*Because of the company which is implementing or developing the application or the solution. They should have a place to run the system for testing. They are not working in Oman; they are in Singapore, so they asked for a space access the storage of UAT, development, and for other issues. These problems are not yet finalised; they have to test the environment to run their business, so they need to have access outside. The ITA (G-CLOUD) does not give access to outside the country. This is creating an issue for the company as they have to come from outside to finish any issue.' PAMR01, 01/10/2015.*

The above findings show how the coercive organisational practices taking place in the NCSI project implementation enabled standardisation to be implemented with minimal resistance. This was due to the influence wielded over the NCSI by the ITA through its financial power and rules and regulations.

6.6.2. Mimetic Institutional force

Mimetic practices also contributed to the implementation of standards in the PAMR project. This was highlighted by a senior manager in the IT department:

> *'All we need to focus on our core business, I think ITA is a trusted place for us, they spend a lot to build the G-Cloud, and I am sure for that propose it will work. Not only have us, but the MOH also knows that ITA is trusted place' PAMR01, 01/10/2015.*

A PAMR project member also added that:

> *'ITA is not only handling one project; they are handling all the projects in the country' PAMR02, 01/10/2015.*

This meant that the PAMR should not have been concerned about the implementation using the G-Cloud as other government agencies were doing the same. The PAMR staff expected the G-Cloud's implementation to be a quick process and that the vendor, with

the ITA's help, would take care of everything; as such, the PAMR was ***taking the G-Cloud for granted***. This was highlighted by an IT staff member in the PAMR:

> '*Because implementation is being done with the vendor, the vendor will tackle the G-Cloud implementation. Personally, I do not have much idea about the G-Cloud, because it is new for us. Even for the PAMR, even we do not have people trained for that purpose, but as I know, we do not need to care about the infrastructure and the maintenance. All we need to focus on our core business' PAMR02, 01/10/2015.*

The PAMR team looked at the other successful organisations that had joined the G-Cloud before it. They felt assured that, as other organisations had joined and there were applications that were running in the G-Cloud, the PAMR should be part of the project. A senior PAMR manager explained:

> '*There are already several government agencies who joined the G-Cloud which we saw…Our system will have a lot of application and lots of usages, through applying and update the information' PAMR01, 01/10/2015.*

The findings show that the PAMR team had accepted the G-Cloud standards as they believed that the implementation would be a simple process and that the vendor would take care of everything with the ITA's help. The cloud computing market rhetoric was a factor in the PAMR's acceptance of the G-Cloud and of its standardisation.

6.6.3. Normative Institutional force

In the implementation of the PAMR project into the G-Cloud, normative practices were not significant, particularly in the early stages of the implementation of the standards to be applied to the project. The PAMR team did not contest the G-Cloud standards as they expected that the G-Cloud's implementation would be immediate and that the vendor would take care of everything with the ITA's help. This was highlighted by one of the PAMR's senior managers:

> '*Because implementation is being done with the vendor, the vendor will tackle the G-Cloud implementation. Personally, I do not have much idea about the G-Cloud, because, it is new for us. Even for the PAMR, even we do not have people trained*

for that purpose, but as I know, we do not need to care about the infrastructure and the maintenance.' PAMR01, 01/10/2015.

The PAMR staff's general knowledge of the G-Cloud was very broad; they knew enough to accept the G-Cloud, but had no grasp of the technical details. One of the PAMR managers explained how she viewed the G-Cloud:

'*As I mentioned, cloud computing provides flexibility, will be more concentration in our business. We do not have to worry about the infrastructure such as server, electricity and others. All we will care about is the SLA' PAMR02, 01/10/2015.*

One of the vendor's staff members for the PAMR project also explained how the G-Cloud team's experience could help in executing the project faster by stating:

'*Yes, because they will be managing a different kind of system. However, if we set up the system here they will have challenges to manage the infrastructure, but in the G-Cloud, they have experience with a different kind of flavour, and all these things and they are aware what they will get. Based on that issue they will design better thing for us' PAMR04, 27/12/2015.*

Moreover, the lack of ***professionals*** within the organisation was a factor in joining the G-Cloud. A PAMR senior manager added:

'*As I mentioned, it is more into saving, plus we do not have enough people qualified and trained to manage the infrastructure. Also, we do not have enough Institute staff who can provide proper training to manage the data centre and other applications' PAMR01, 01/10/2015*.

When it came to ***training*** the IT staff, no one attended any training sessions related to the G-Cloud. However, the employees stressed the importance of training. The senior manager added that;

'Training is essential, particularly when it comes to the staff who are directly involved with cloud implementation. Now we do not have any training in G-Cloud. Training is necessary, and we are part of the government, and the G-Cloud is part of e-government network, and it is good to understand how it runs' PAMR01, 01/10/2015.

The above finding shows that the normative mechanism in the implementation of PAMR project contributed to its standardisation as the PAMR team did not contest the implementation of standards in its systems. The PAMR team had moderate knowledge of the cloud computing concept and accepted the standards imposed by the ITA team. Moreover, the NIMR project did come with its own standards, but these were only related to the internal operation of the system, and mostly did not conflict with the ITA's standards.

6.6.4. Summary of practices for the PAMR portal

This section summarises the PAMR's implementation practices that led to the standardisation of its e-portal. Financial resources, human resources, Stakeholder power, and control organisational practices contributed to the coercive mechanism. IT knowledge, professionalism, experience, and training did not contribute to the normative mechanism. Taken-for-granted, best practice and successful organisations contributed to the mimetic mechanisms. Figure 6.6 summarises all the practices that contributed to the standardisation of the PAMR's NIMR project in the G-Cloud.

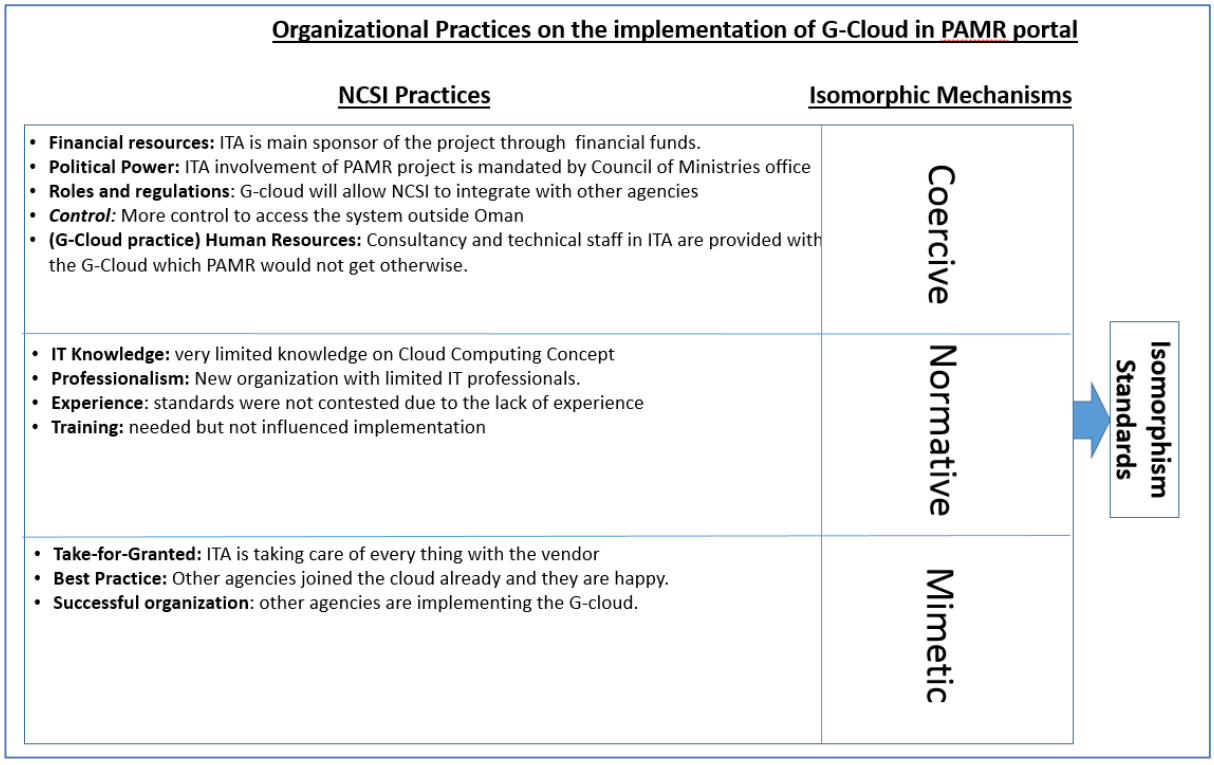

Figure 6-6: Organisational Practices in the implementation of the G-Cloud in the PAMR's e- portal

6.7. (e-government service division) eOman Portal organisational practices

The isomorphic mechanisms that led to the implementation of the G-Cloud standards in the eOman portal were evident and shaped how that project was implemented in the G-Cloud. Some issues and challenges arose during the migration of the eOman portal to the G-Cloud. Presenting these issues and challenges will help better explain the organisational practices. Once the decision had been made, the main task of the eOman portal team was to migrate to the G-Cloud through a planned process. The migration from one platform to the other was expected to be a very simple task, as stated by an eOman portal staff member. It was supposed to be just a matter of switching infrastructure. However, the system was interrupted for some time. The eOman team had to freeze the content for longer than it had expected. The G-Cloud team had promised that any errors would be resolved in no more than two weeks; instead, it took them two months. A manager in the eOman portal explained:

> '*For example, there were some mistakes, the services of Muscat Municipalities were moved to the regional municipalities, so there was extensive UAT, we have to involve all government entities and asked them for their help, and this was because of migration. Everything was right, content was in the right place, service was in the right place, but when we moved, we had these issues. It was a really bad experience, and they failed that commitment. We were not able to work on it for two months, they failed that commitment, they wanted to freeze for two months, but we told them we could not do this as we update our portal daily' ITA04, 26/11/2015.*

However, when the eOman portal team decided to move its OpenData portal (part of the eOman portal), many technical issues had been solved as the G-Cloud team had learned from its mistakes. For example, performance was an issue at the early stage with eOman, but was resolved after fixing the errors made by the vendor.

The manager still believed that more work would be needed for the G-Cloud to become a professional service provider for government agencies. When the G-Cloud team was approached to get a service for the OpenData Portal, the process was not as smooth as expected. The team again went through a process by which the G-Cloud team gave it a form to fill out and looked at the VMware's logical architecture to see how to balance the

traffic and to scale it and upgrade it over the following five years. The eOman portal project manager explained:

> *'The procedures to join the G-Cloud were not smooth with the Data portal, and we were given many feedbacks along the process; if you drag the government entities through this hassle they will not continue with you. We were telling them exactly if you are going on like this, it will be very difficult for you to go on like this and attract the government entities' ITA04, 26/11/2015.*

Although some challenges arose during its migration, various institutional forces contributed to the standardisation of the eOman portal in the G-Cloud.

6.7.1. Coercive Institutional force

The decision to go for the G-Cloud was mandated by the ***top managements*** to save on costs compared with the previous IBM VMware solution. The ITA management was about to renew the IBM contract for the eOman portal, which would have been for three years and involve high costs. As the ITA had a plan to develop a G-Cloud solution for government agencies, the management decided not to renew the IBM contract and speed up the G-Cloud project. A senior ITA manager stated:

> *'The portal was the first project, and we wanted to walk the talk, the move was in 2014' ITA03, 26/11/2015.*

Therefore, the decision was made by the top ITA management, and was forced on the eOman portal management team.

Moreover, the G-Cloud team wanted to impose some of its software solutions on the eOman portal instead of using the costly IBM WebSphere, but the eOman team refused as it thought it would involve much more effort and be too risky. By its ***Client requirement***, the eOman portal team forced the G-Cloud team to rethink its decision and only provide IaaS. The eOman portal manager clarified:

> *'About the knowledge and the training we have in this application, if we are not resisting, it would be much easier to work with the one they have, but it is the matter having to live in the right way' ITA04, 26/11/2015.*

Once the migration from the old environment to the new G-Cloud one occurred, issues and challenges started to appear; for example, issues related to ***control*** and security control in particular. The PKI was a challenge for the eOman portal team when it joined the G-Cloud, as its requirements were different. The eOman project manager explained:

> *'The same with the PKI, we wanted to use the mobile PKI to have it in the portal, as we are supposed to have the sign-on technologies in the country. We were against the sign on; the portal is acting as a federated, you can go anywhere on signing on. It is a Single Sign-On (SSO) with mobile, PKI is not an SSO anymore. If you are in that portal, you can go anywhere to sign in' ITA04, 26/11/2015.*

The decision to move to the G-Cloud was made by the top officials in coordination with their technical team. The ITA team's coercive practices resulted in the implementation of standards in the eOman portal. Although the implementation did not go smoothly, it did succeed in migrating the eOman portal to the G-Cloud.

In relation to the organisational practices involving coercive mechanisms in the eOman portal, the findings show a clear coercive force that resulted in the standardisation of the eOman portal in the G-Cloud.

6.7.2. Mimetic Institutional Force

In regard to the mimetic institutional forces related to the eOman portal, its staff considered the G-Cloud as a ***best practice*** that should have worked easily for them. Moreover, there were good examples of ***successful countries*** using the G-Cloud. The director of the eOman portal explained,

> '*Because it is becoming the practice, international, and always ITA want to be a leader when it comes to the best practices and, of course, with the benefit that comes with the G-Cloud, like cost-cutting, speed, etc.*' ITA04, 26/11/2015.

This concept was shared among the eOman team, which found no previous experience within the country to take as a role model. Therefore, the team considered successful cases from other countries and best practices outside Oman.

The study shows that the eOman portal team knew about cloud computing and realised how the successful implementation of the solution in other countries; this practice contributed to the standardisation of the eOman portal in the G-Cloud.

6.7.3. Normative Institutional force

As explained above, the migration to the G-Cloud was clearly a management decision that was imposed on the eOman team and created resistance from it when the ***experienced staff*** who managed the portal criticised the change. However, it had no control over any changes. An eOman portal manager added:

> '*The G-Cloud is still very premature to assess, but we notice an improvement on it, I cannot give an answer now; maybe after one year it will be better. Maybe they will change, and when they provide us with a dashboard and be able to scale and move thing around, then I can talk in more sense, now they are like another NDC to me, they provide IaaS to host my portal, and that is it' ITA04, 26/11/2015.*

In terms of the team's general ***knowledge*** of the benefits of cloud computing, they did have a solid understanding of how the technology operated, and they did understand how it could benefit their project. However, their normative knowledge did not help in the standardisation of the G-Cloud as a coercive institutional force.

The implementation process was not straightforward. It was supposed to be a simple migration; however, there were challenges, especially because the eOman portal was the first application hosted in the G-Cloud and both the vendor and the eOman portal team gained knowledge from this implementation. An eOman portal staff member stated:

> '*As I told you, it was very basic learning for everyone, even for the G-Cloud team, they are also learning. We were fixing errors, being able to go to the development and adding content. We had lots of complaints and lots of calls, but it was all about the content. Even the performance was not that well, but eventually, it is fine now'ITA07, 30/11/2015.*

The above finding shows that organisational practices involving normative mechanisms caused resistance to standards by the professionals who managed the e-portal. However,

those practices did not result in changes to the G-Cloud standards, although they did result in acceptable delays in the e-portal going live.

6.7.4. Summary of practices for the eOman portal

This section summarises the eOman portal's implementation practices that led to its standardisation. Top-down, Client requirements, and controls practices contributed to the coercive mechanism. Experience and IT knowledge practices played a role in the G-Cloud migration but did not contribute to the normative mechanism. Successful countries and best practices contributed to the mimetic mechanism. Figure 6.7 summarises all the practices that contributed to the standardisation of the eOman portal in the G-Cloud project.

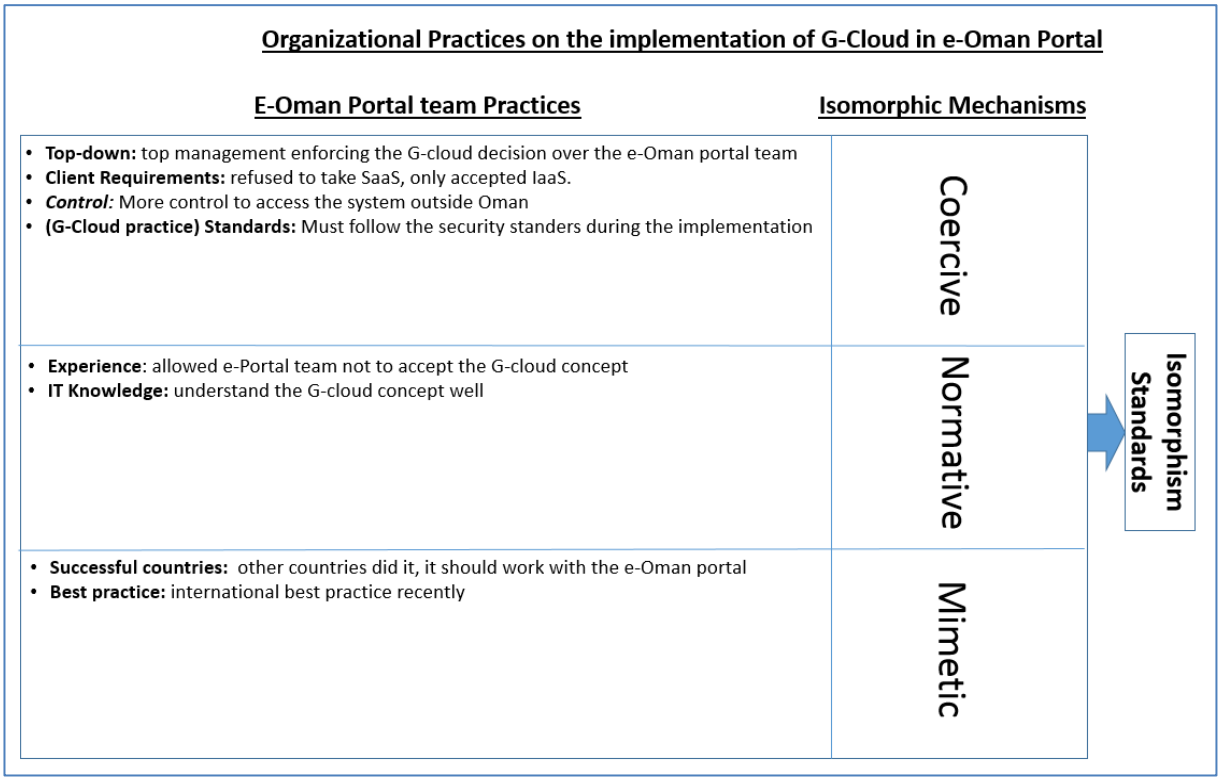

Figure 6-7: Organisational Practices in the implementation of the G-Cloud for the eOman portal

6.8. Summary of Organisational practices in the G-Cloud

Table 6.1 summarises the organisational practices which led to standardisation in the four case studies discussed in the next chapter. These practices were identified from the

literature of management and information management studies and are associated with institutional forces. The literature shows a number of organisational practices related to the coercive institutional force. These are: top-down, centralised policy, rules and regulations, client requirements, stakeholder power, sanctions/punishments, financial control, policy documents, surveillance, compliance, and imposed organisational structure. The literature also shows organisational practices related to the normative forces, which are culture acceptance, professionalism, experience, installed base, certificate, training, routines, and unions. The mimetic forces also have organisational practices such as mimetic culture, taken-for-granted, relevant best practices, role models, uncertainty, peers, and successful origination or a country. This study used these practices to analyse the case study and found certain practices that are particularly related to the implementation of the National G-Cloud Programme in Oman. These practices were identified in different embedded case studies. Not all practices were identified in each case, as every case had different ways of approaching the G-Cloud. These differences are explained across different cases in section 7.2 in the discussion chapter.

Although the study highlights the dynamics involved in achieving standardisation in certain government agencies through the National G-Cloud Programme, for various reasons mentioned above, some government agencies contested or rejected those standards during the implementation stage; this, however, did not influence standardisation. Moreover, the ITA allowed other government agencies not adopt the G-Cloud programme and gave them time to decide or have their information infrastructure developed locally. The conceptual framework showed the organisational practices that lead to the standardisation of G-Cloud. The normative practices have resulted in the failure of the system implemented which in turn did not result in the standardisation of the information infrastructures in previous studies (Currie 2004; Currie et al. 2007; Swanson et al. 1997). This conflict results in a scenario where an innovative system or process may fail to become institutionalised regardless of its potential to change working practices. The analysis of data in this research shows that normative forces have not resulted in the failure of G-Cloud implementation. Figure 6.3 shows the revised conceptual framework which will be discussed in details in the following section.

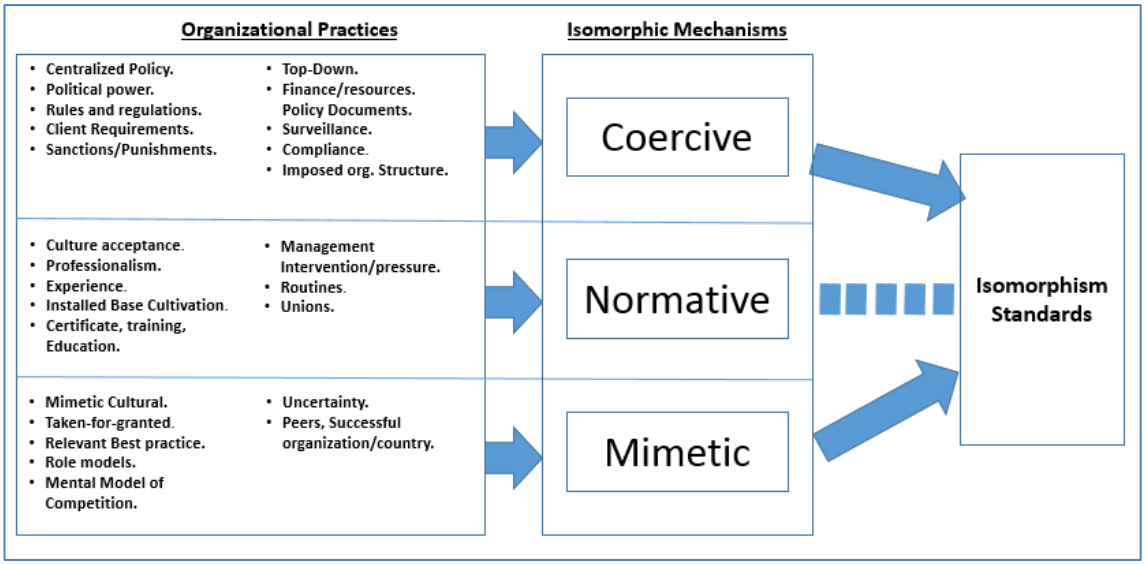

Figure 6.3: Revised conceptual framework

Exploring those rejections of standardisation, along with the concept of achieving standardisation, will be important in the discussion chapter. On the other hand, the ITA wielded either direct or indirect influence over the four case study government agencies to join the National G-Cloud Programme in Oman due to their customer-oriented nature.

Table 6-1: Organisational Practices which led to standardisation in the government agencies

Mechanism	Practice	MoH	NCSI	PAMR	eOman
Coercive	**Centralized Policies**	X	X		
	Stakeholder Power	X		X	
	Financial	X	X	X	
	Rules and Regulations	X	X	X	
	Security Standards	X	X		X
	Compliance	X			
	Organizational Structure		X		
	Top-down Decision	X			X
	Human Resources	X		X	
	Client Requirements	X			X
	Controls		X	X	X
Normative	**Professionalism**	X	X	X	
	Training	X		X	
	Management interaction – Conferences				
	General/IT Knowledge		X	X	X
	Experience	X	X	X	X
Mimetic	**New Trend**	X			
	Best Practice	X	X	X	X
	Role Model	X	X		
	Taken-for-granted			X	

	Market-rhetoric	X			
	Successful countries/organisation	X	X	X	X

6.9. Conclusion

This chapter discussed the research findings on the implementation of the National G-Cloud Programme in Oman. The chapter started by highlighting the findings of the practices that resulted in the standardisation of the implementation of G-Cloud computing in the ITA. Then, the chapter discussed the dynamics of how standardisation was achieved in each government agency. Four embedded case studies were investigated to highlight how isomorphic mechanisms led to standardisation. The case studies were the Ministry of Health's e-portal, the National Centre for Information and Statistics' portal, the Public Authority for Manpower Register's e-Portal, and the Information Technology Authority's eOman portal.

7. Chapter Seven: Discussion

7.1. Introduction

Chapter five provided a detailed description of the case study of Oman's National G-Cloud Programme implementation stage. It also discussed and described the four embedded case studies of government agencies that have adopted and implemented their e-portals into the G-Cloud. Chapter six then analysed the findings obtained from data gathered, following the framework developed in chapter three (Theoretical Framework). This chapter discusses the main themes that emerged from the research findings in chapter six. It examines the findings and analyse them in light of the main research questions of this thesis that ask: How do institutional forces affect the implementation of government cloud computing? and what organisational practices can lead to the adoption and implementation of cloud computing in government? This chapter also discusses the implications of using theoretical frameworks based on institutional theory to understand information infrastructures. It revisits the literature review and contributes to existing understandings of how information infrastructures, and more specifically, government cloud computing, can be implemented.

Section 7.2 discusses the role of institutional forces on G-Cloud implementation by providing a cross-sectional study of all four case studies and how each institutional force contributed to the standardisation of e-portals in the G-Cloud. Section 7.3 discusses the implications of the findings according to three research areas: cloud computing research, information infrastructure research, and intervention studies. The final section presents the conclusions of this chapter.

7.2. The Role of Institutional forces in G-Cloud Implementation

The previous chapter (chapter six) examined the different organisational practices of each institutional force for the four case studied and how these forces led to the standardisation of these government agencies' e-portals in the G-Cloud. This section will discuss the coercive, mimetic and normative institutional forces across all four cases to develop a robust and a more comprehensive understanding of the role of institutional forces in achieving standardisation of the e-portals during project implementation in different government agencies in the G-Cloud. It brings together the key issues and insights by

comparing each force across all four case studies. Each institutional force is identified with its related organisational practices to help to analyse the case study. It starts by explaining the findings through the theoretical framework identified in chapter three. The subsections which follow then review each institutional force and the part these forces played in the implementation of the G-Cloud.

7.2.1. G-Cloud Implementation through Institutional Forces

Institutional forces are a cornerstone of institutional theory that focuses on the stability of institutions (Scott 2001). Government organisations operate in the highly institutionalised organisational field (Currie 2012). Institutional forces, therefore, play an important role in information infrastructure solutions such as the G-Cloud. The G-Cloud is a form of information infrastructure in which resources are centralised and work in the virtual setting. Applying standardisation to the different government agencies became one of the main challenges of implementing the G-Cloud. It is argued in this research that coercive, mimetic, and normative institutional forces play an important role in implementing the G-Cloud.

The study shows that the coercive and mimetic forces play a significant role in establishing the standards which allowed successful implementation of the G-Cloud programme in the four government agencies. The organisational practices of normative forces caused resistance to various standards of G-Cloud implementation from professionals in the government agencies. This resistance was seen in several professionals during G-Cloud implementation but did not result in delays in implementing the G-Cloud programme in these government agencies. Examples of this resistance were the temporary introduction of the mini-cloud, the workaround in the MoH, some of the security restrictions, and space requirements for the NCSI portal.

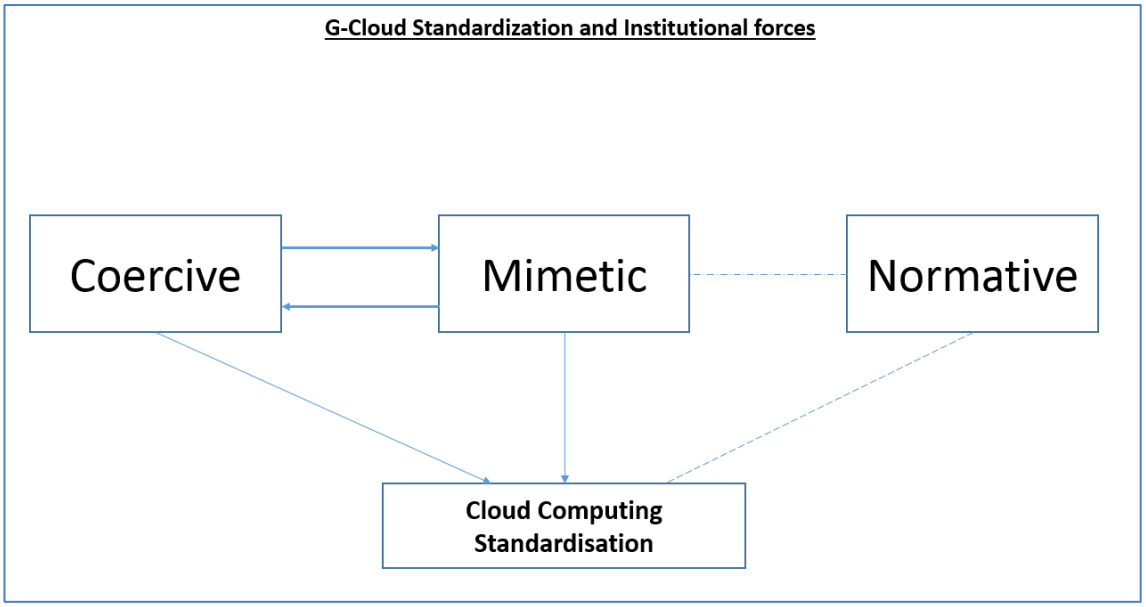

Figure 7-1: Institutional forces which lead to G-Cloud implementation

Figure 7.1 shows the interaction between the three institutional forces and how these forces led to the standardisation of cloud computing. The figure shows how the coercive and mimetic forces played an important role in achieving cloud computing standardisation and overshadowed the normative forces. The coercive and mimetic forces were enough to ensure the standardisation of cloud computing in Oman's National G-Cloud Programme.

The next section looks at the case studies to see how each of the institutional forces contributed to the implementation of the National G-Cloud Programme in Oman.

7.2.2. Coercive Forces

The coercive forces were evident in the implementation of government IT systems in each government agency into the G-Cloud. Although some of the ITA staff interviewed said that the ITA did not force anyone to join the G-Cloud, the ITA's practices during the pre-implementation and implementation indicate that it had exerted coercive pressures over them. The coercive pressures came from different forms of organisational practices that were imposed on the government agencies by the ITA by power influence, different forms of incentives, and by imposing the rules and regulations. In addition to this, security

standards were stood out as an organisational practice that was unique to the G-Cloud case study.

Top-down practices are commonly used by national governments or central bodies to achieve their objectives by placing pressure on organisations or subordinate departments over which they have influence (Dobbin 1994; Jensen et al. 2009). Implementation of the National G-Cloud Programme was a typical example of this. In general, most of the coercive organisational practices in this case study were imposed by the more powerful ITA on the four less powerful government agencies. The top-down force was applied differently from one government agency to another. For example, in the MoH case, the ITA's top managers mandated the use of the G-Cloud as the infrastructure of the e-Health portal. In the cases of the NCSI and PAMR, the CEO of the ITA was also a board member of these agencies and could exert top-down influence for their e-portals to be in the G-Cloud. The eOman portal was managed and controlled by the ITA, and the decision to migrate it to the G-Cloud was influenced by the ITA's top manager. The ITA used different top-down approaches to impose standardisation depending on whether it had direct or indirect authority in each government agency.

Another organisational factor in the form of coercive force exerted by the ITA over the government agencies was the stakeholder power it had over them. The stakeholder power here was authority the ITA had been given by the government to impose change on government agencies. The ITA's organisational structure allows it to make IT-related decisions for the national interest. Hence, the ITA gave priority to projects that are considered nationally important and considered the four e-portals as important national projects. The ITA management team reiterated that they gave priority to the e-transformation projects. Many of these were under development or in the planning phase, making it easy for the organisations and the ITA to build their application on the G-Cloud-enabled environment from the start. Stakeholder power-structure pressure from the ITA was imposed on these government agencies to join the G-Cloud. While the NCSI portal and the PAMR project were influenced by the membership of the CEO of the ITA on boards, this pressure was also observed with the MoH with which the ITA did not have a direct relationship. This practice is consistent with other findings that recognise the role of stakeholder power in implementing IS systems in government agencies (Currie 2012; Currie et al. 2007; Grimshaw et al. 2006).

All government agencies agreed that the zero-charge policy was a motive to join the G-Cloud. At the same time, the ITA funded the MoH and PAMR projects, which meant that financial incentives acted as pressure on the government agencies to adopt the G-Cloud and accept its standardisation. All the government agencies knew that if they did not comply with standards of the ITA, there would be no financial support for the projects and the ITA will stop funding their projects. Additionally, according to the interviews, the government agencies were not provided with budgets to build the IT infrastructure for their e-portals. Not agreeing to be part of G-Cloud would have amounted to being financially sanctioned. Financial considerations were less important to the NCSI. Its main objective in joining the G-Cloud was to achieve integration with other government agencies, and its statistical portal only needed to migrate from the old infrastructure to the G-Cloud. However, the experience of the MoH and the PAMR is consistent with other studies where an organisation has exerted financial pressures over other organisations (Gozman et al. 2014; Nicolaou 1999).

As the government organisation with authority to set up the rules and regulation of IT policy, the ITA was able to adopt a centralised approach to IT governance and implementation of IS in government. The case-study analysis showed that the ITA was able to impose many of its standards, rules, and regulations related to IS implementation and governance. One example of this was the access policies for IT systems. This finding supports other studies that argue that a centralised policy of rules and regulations contributes to the successful acceptance of different standards for IT systems. One such study was by Benders et al. (2006) who examined headquarters standards, and another was Brown et al. (2011) study of e-government implementation in Jamaica.

In the later stages of implementation, other organisational practices in the form of coercive pressure also resulted in the standardisation of IT systems that adopted the G-Cloud. Issues of roles and responsibilities were not clearly defined in advance, which meant that the ITA could ask the vendor to implement many controls and standards at different implementation stages. These controls and standards were also imposed on the government agencies throughout the implementation process. The ITA team did recognise different challenges when implementing the e-portals into the G-Cloud. For example, the government agencies came with the mindset that the ITA should not have control over their systems and that they should have full control of the implementation process. This was evident from the interviews, where one of the interviewees stated that

the G-Cloud should be an infrastructure on which an e-portal can be built without any inscription into the application.

What they did not realise is that the ITA offer was for infrastructure and services. Consequently, the ITA had the power to control many features in the G-Cloud that the government agencies were not clear about it. This could be seen when government agencies requested control over some features and wanted data privacy, which is not technically feasible with the G-Cloud. It will take time for the agencies to go through the learning process of how the G-Cloud operates and to understand and acquire the knowledge they need. However, the government agencies' lack of knowledge about how G-Cloud runs and their various demands did not hinder the implementation of their e-portals, as the ITA fully controlled and managed the operation of the G-Cloud. It can be concluded that the ITA's control practices helped to implement the G-Cloud's standards despite the demands from government agencies.

In the implementation stage, the interaction between the ITA and the government agencies triggered expected and unexpected coercive practices. The unexpected practices are a result of the G-Cloud being a new concept for both the ITA and the government agencies. Although the ITA initiated the project, it did not have a clear plan for which government agencies would implement their systems in the G-Cloud. Even when the government agencies were known, the responsibilities of the team members in both the ITA and the government agencies were not clearly defined. The benefits of the G-Cloud solution for the government were evident, and the G-Cloud team and government agencies expected changes as the project progressed and saw flexibility as a need. There was uncertainty, and this was one reason that the ITA did charge the organisations using G-Cloud services at this stage. Charging fees would have imposed pressure on the ITA to deliver quality services within a predetermined timeframe. The realisation of the benefits and acceptance of flexible standards are consistent with previous studies that have demonstrated the role of flexible standards as an enabler and key developer for information infrastructure (Bhatt et al. 2010; Braa et al. 2007).

The ITA also made sure that all their required standards were embedded in their G-Cloud application. It had stated in the tender documents that the project should comply with the best standard of cloud implementation and general security standards as followed by the ITA. However, the details of these standards were not specified as the G-Cloud was a

new concept for the ITA, and some standards and requirements might emerge while the application was being developed. The contract was for the development of the G-Cloud and its operation for three years, but like most operation contracts, it had the flexibility to allow the client to ask for reasonable changes in systems. The ITA, as the client, could, therefore, instruct the G-Cloud vendor to embed ITA standards into the G-Cloud, which in turn became part of the application that the government agencies had to accept and comply with.

Security controls were another practice by the ITA which had a major influence on the implementation of standards. The ITA allowed government agencies the freedom to operate their IS applications and systems within the scope of the agreement. However, the ITA ensured that the scope of the agreement included the ITA's right to enforce security policies and requirements before opening the service to the government agencies. This was because the G-Cloud is a security-sensitive project. The Information Security Division (ISD) of the ITA played a significant role in G-Cloud implementation by requiring the ITA's vendor and the government agencies to strictly follow its security guidelines. The government takes the protection of its data very seriously, and it has invested heavily in security. The government of Oman was ranked third globally as a country with some of the best organisational security practices, and these are due to its excellent security strategy and comprehensive roadmap (ITU 2015). That is why a senior manager of the ISD, who was a member of the G-Cloud steering committee, ensured that security standards were met based on best international practices from the top level. These standards are mainly derived from the Cloud Security Alliance (CSA), which is a component of National Institute of Standards and Technology (NIST), and standards drafted by the ISD team. The ITA mandated these standards for the cloud, and the security division worked as the regulator of security issues related to the G-Cloud. The security division mandated that the G-Cloud must meet these standards and audited them against these and the ITA's internal standards.

Although, these standards were mandated by the ISD to be applied in G-Cloud implementation and for government agencies using the G-Cloud, there were no clear, documented guidelines for them to follow. The ISD team was in the process of developing a checklist for distribution to all future G-Cloud clients so they could follow it and obtain approval from the ITA. Among other measures, the checklist includes network and penetration testing.

The issue of imposing security standards was raised many times during interviews with government agencies that were in the implementation stage. These standards were articulated differently depending on the position of the people interviewed and how well they understood the concept of cloud computing. For example, management saw the imposition of standards and controls as important because they would enhance their application and make it secure from attack. Technical users believed that these controls and standards created challenges for their e-portals to go live and made using them more difficult for users and technical people.

One of the security standards raised by all government agencies was the requirement to implement Public Key Infrastructure (PKI) in order to be part of G-Cloud. The PKI initiative, which is owned and operated by the ITA, aims to ensure the integrity, authenticity, and confidentiality of data and the identity of natural and legal persons accessing to these data. The initiative supports the set-up of trusted spaces by using encryption, authentication, and digital signature functions. These trusted spaces will help provide privacy of information and the identification and authentication of citizens/users and government agencies. Such trusted spaces can be shared with a large population of users inside and outside the Sultanate of Oman (ITA 2014b). For government agencies, accessing G-Cloud application can be either through Mobile PKI or an ID card. During the implementation stage of the G-Cloud, both options required the government agencies to authenticate the technicians' ID cards. Even though difficulties and complexities from the technician's perspective were expressed, the ITA believed it was necessary for government agencies to comply from the outset so security would become part of the work environment in the future. This again shows how the coercive forces contributed strongly to the standardisation of e-portals in the G-Cloud.

The organisational practices detailed above show the existence of coercive force over the government agencies during the implementation stage of the G-Cloud as an infrastructure for their e-portals and acceptance of the standards that come with the G-Cloud. The theoretical framework chapter discussed practices that have been identified in the previous literature. These practices are top-down management, centralised policy, stakeholder power, rules and regulations, G-Cloud application requirements, sanctions, financial incentives, policy documents, compliance, and imposed organisation structure. Most of these practices have been imposed on the government agencies to encourage them to adopt the G-Cloud and implement its standards. Figure 7.1 shows the coercive

forces that the ITA imposed on the government agencies to achieve standardisation. Although many of these practices have been identified in the previous literature, there are practices that are unique to this case study, such as security standards and management control. Through the G-Cloud, the ITA was able to impose security standards and control over the government agencies that it had not been able to impose in previous projects. In addition to this, management control by providing dedicated ITA staff to government agencies such as the PAMR helped to achieve standardisation.

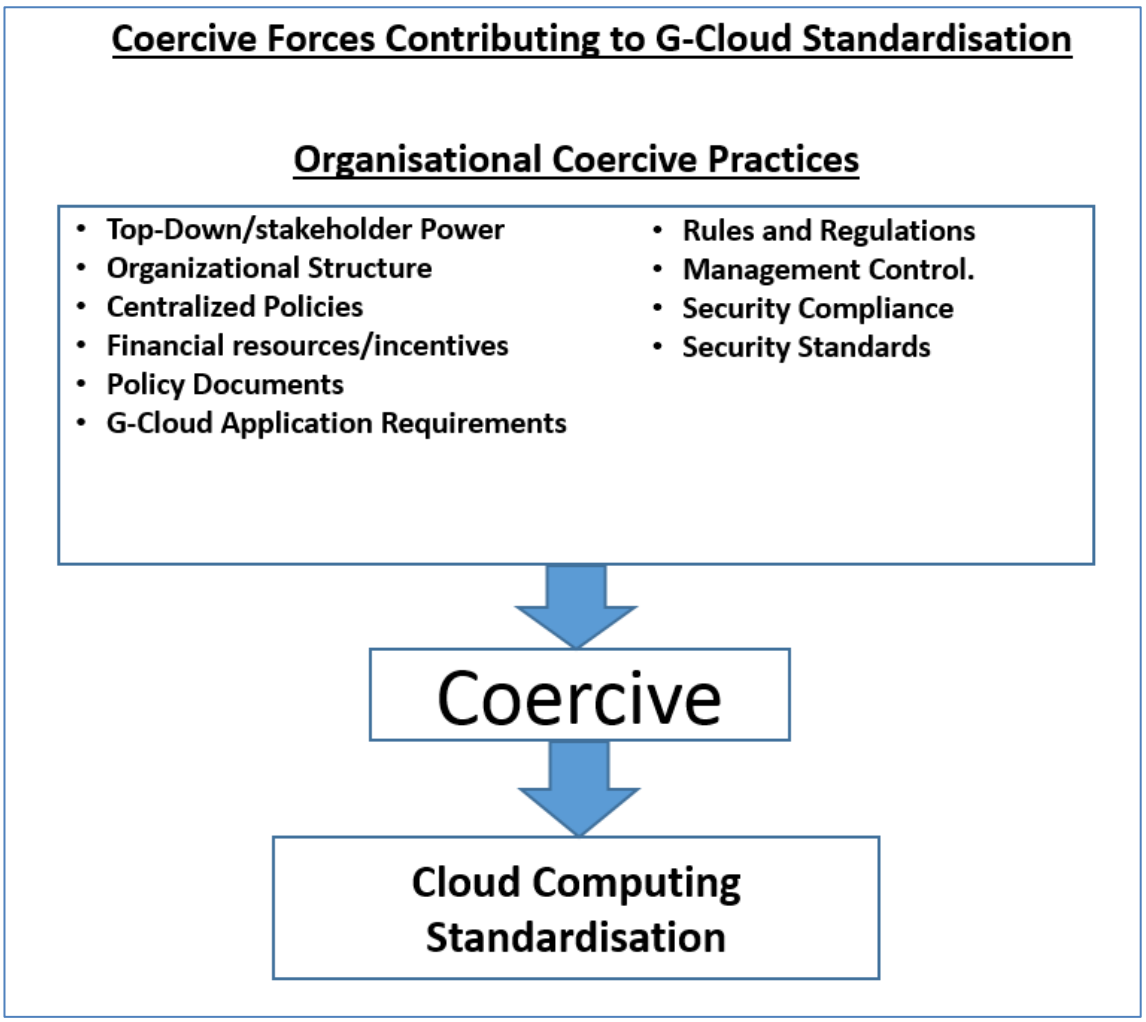

Figure 7-2: Coercive organisational practice that led to standardisation

The discussion above shows that coercive forces played a crucial role in the implementation of G-Cloud for the different government agencies. The practices imposed on the government agencies contributed to the standardisation of their e-portals when they agreed to host their applications outside their premises and accepted the standards that come with the G-Cloud, such as security controls and acceptance of PKI authenticity.

This is consistent with other studies that show the role coercive forces play alongside the other forces, leading to successful project implementations (Brown et al. 2011; Currie 2012; Grimshaw et al. 2006).

7.2.3. Mimetic Forces

The mimetic forces in this case study can be identified as government agencies who adopted the government cloud computing as a new trend which is being implemented in other countries, government agencies which implemented the G-Cloud because other government agencies had already done this, and organisations who took the cloud for granted because they were uncertain of their goals and objectives. The organisational practices of the mimetic forces depicted in the analysis are one the following: a new trend, best practices, a role model, market rhetoric, successful countries, or successful organisations.

Before the adoption of G-Cloud services, the government agencies had already heard about the benefits of the technology. All the government agencies considered cloud computing as a new trend and looked to the opportunity to be part of this new, internationally practised technology.

The MoH was the first government agency to adopt the G-Cloud. When asked about the benefit of the solution for them, they mentioned that other countries are benefitting from the G-Cloud, and it is important that their organisation take advantage of this solution. They looked at Estonia as a successful country that had implemented G-Cloud solutions for government agencies. Uncertainty about how this solution runs became a powerful force that led the MoH to accept and imitate solutions in other countries. The MoH faced challenges in having the IT infrastructure needed to launch its e-Health portal. When organisations face a problem with an unclear solution or uncertain causes, a search may result in a viable solution with little expense (Cyert et al. 1963). This was the same for the NCSI project, as the staff wanted to be one of the first to adopt cloud technology and they looked at a peer organisation, the MoH that had already implemented the G-Cloud. By looking at other organisations, the NCSI modelled itself in response to uncertainty (DiMaggio et al. 1991). The NCSI saw the MoH as more legitimated and successful as it was a larger organisation and had more IT implementation experience. Looking at

successful countries and successful organisation were major mimetic forces that encouraged the MoH and the NCSI to adopt and implement a G-Cloud solution.

The PAMR's reasons for using G-Cloud were not clear. They had taken the technology for granted, as they did not have a good knowledge of it and expected that the ITA would do all the implementation. The ITA team recognised that some government agencies, like the PAMR, took the G-Cloud for granted because they did not know enough about the solution, but they believed that it would solve their problems. The PAMR team were confident in their faith that the ITA would provide a trusted solution which already been applied in other places.

The mimetic forces also played a major role for the MoH. The MoH implementation was the first outside the ITA, and many government agencies wanted to become a showcase by being the first to implement their system in the G-Cloud. The PAMR had also seen the MoH implementation, and they looked at this organisation as a role model. The IT staff of the MoH constantly referred to the importance of implementation, based on their knowledge of other organisations and other countries. Figure 7.2 shows the mimetic forces which the ITA exerted over the government agencies to achieve standardisation.

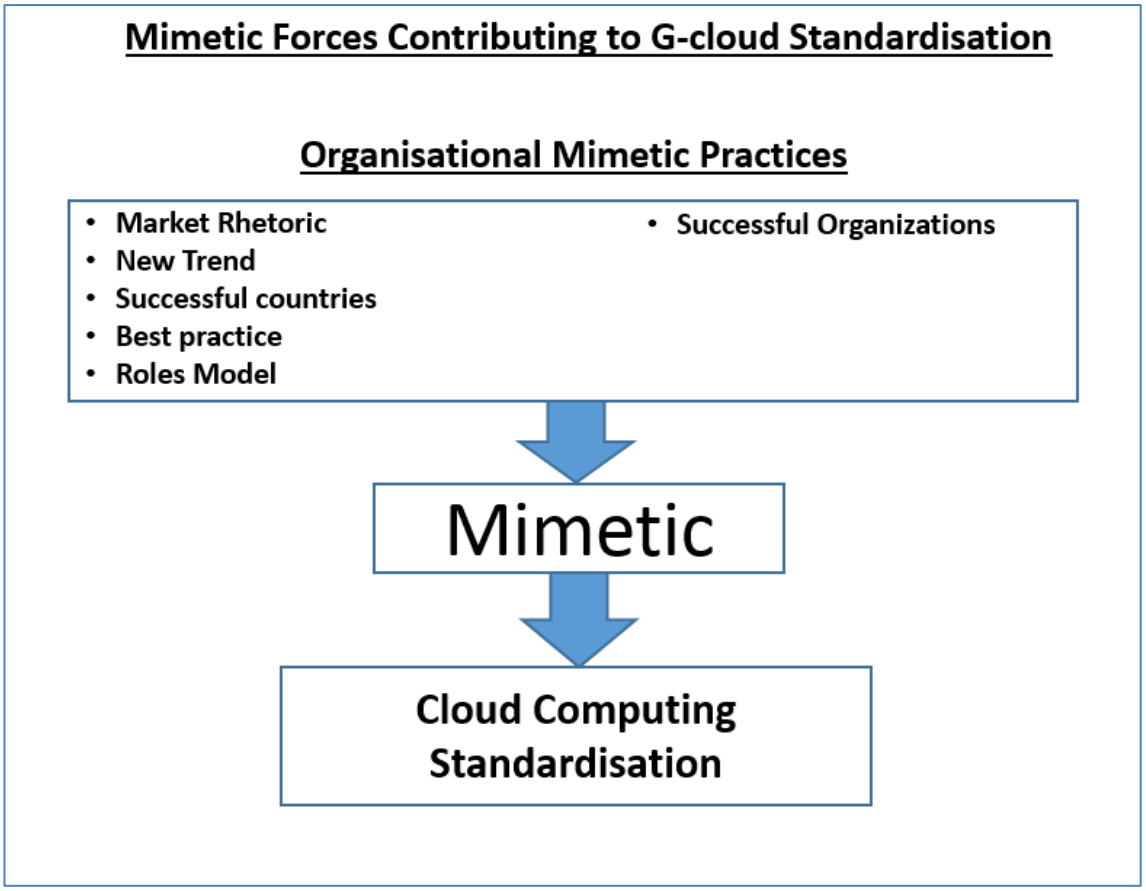

Figure 7-3: Mimetic organisational practice that led to standardisation

The above discussion shows that mimetic forces contributed to the implementation of all government agencies' e-portals into the G-Cloud, and mimetic organisational practices led to the standardisation of these e-portals. These findings are in line with other findings that acknowledge how mimetic forces triggered implementations (Currie 2012; Daniels et al. 2002; Guler et al. 2002). For example, in Currie (2012) case study of the national IT programme for the NHS, his findings of the mimetic processes were interesting. The NCRS of the NHS was poorly understood both in policy terms and as a practical solution for healthcare. Both its goals and potential outcomes were unclear. The NHS looked for role models and found one in the financial services organisations. The NHS decision makers were convinced of this model's successful IS implementation and saw it as a model to be followed.

7.2.4. Normative Forces

As was evident in the case study, organisational practices relating to normative forces did not have the same effect as the coercive or mimetic forces. Normative practices can be categorised as the presence of professionals in the government agencies' teams, the experience of the IT team, general knowledge about cloud computing, cultural acceptance, management interaction, communications, conferences, and training.

The role of professionals was apparent during the project implementation of the G-Cloud. MoH professionals had much more knowledge about how cloud computing operates. The vendor's project manager and the ITA team together solved many issues related to implementation. It was a learning experience for both the ITA G-Cloud team and the MoH team. When implementation started in other government agencies, the role of professionals was not as important as it was in the MoH. This was because professionals in these government agencies assumed that the G-Cloud is an infrastructure and the ITA would take care of all the implementation issues. In addition, the knowledge that the G-Cloud team gained from their experience with the MoH improved their knowledge and enabled them to provide better service to other government agencies.

Another noticeable issue with many government agencies was their limited understanding of what the G-Cloud offered, and this was due to a lack of communication. These government agencies were confused about what the ITA was promoting and what was offered. For example, SaaS was promoted as one of the services the ITA offered, but when government agencies approached the ITA, they were asked to wait until all testing had been finalised. The users were not clearly told that it would be a full-service offer. As well as this, the service level agreement (SLA) between the ITA and the government agencies was not clearly defined. The ITA argued that it was using a flexible concept or agile model in project implementation, as they kept learning as they progressed towards implementing the G-Cloud and considered it as a new experience for all parties. For example, the ITA launched the G-Cloud helpdesk after receiving a complaint from the MoH that the response time was slow and there were difficulties in finding the right person. It is apparent that management interaction and communication issues could have helped to close the gap between the ITA and the government agencies, which in turn would have reduced the concern that government agencies felt during the implementation of the G-Cloud.

All parties agreed that training in using the G-Cloud technology was necessary for all users. However, the professionals who knew how the G-Cloud functioned believed that there was no need for professional training to operate the G-Cloud, but only for training on how to set up the interface, which is a critical part of the G-Cloud. The MoH and NCSI team thought that training on the interface should be sufficient to operate on the G-Cloud, while the PAMR team believed that all their technical staff needed full training on how the G-Cloud functions and operates so they could manage their infrastructure better.

While some professionals in government agencies helped to implement the G-Cloud and achieving standardisation, other professionals negotiated issues related to applying standards, believing that standardisation would hinder the usability of their application. For example, the MoH portal team had issues with the security standards that delayed putting many modules online. The MoH pushed the G-Cloud team to bypass these security blocks so they could go live first and solve the security issues later. The eOman portal team rejected the SaaS G-Cloud application, as they had been trained and had a good knowledge of their current application. Figure 7.3 shows the organisational practices that led to normative forces in the implementation of e-portals in the G-Cloud.

The ITA team explained that some government agencies, such as the PAMR, were taking the G-Cloud for granted. But they did expect that once they learnt more about it and understood the concept, they would ask more challenging questions. The ITA team acknowledged that they were leading their customers, as their customers did not have the requisite knowledge. The government agencies accepted the ITA leadership for their project development because they were getting the service without charge. This shows that the ITA team believed that the normative forces during the process of adoption and implementation of the G-Cloud did not create any challenges for those government agencies. It follows that mimetic forces were stronger than normative forces.

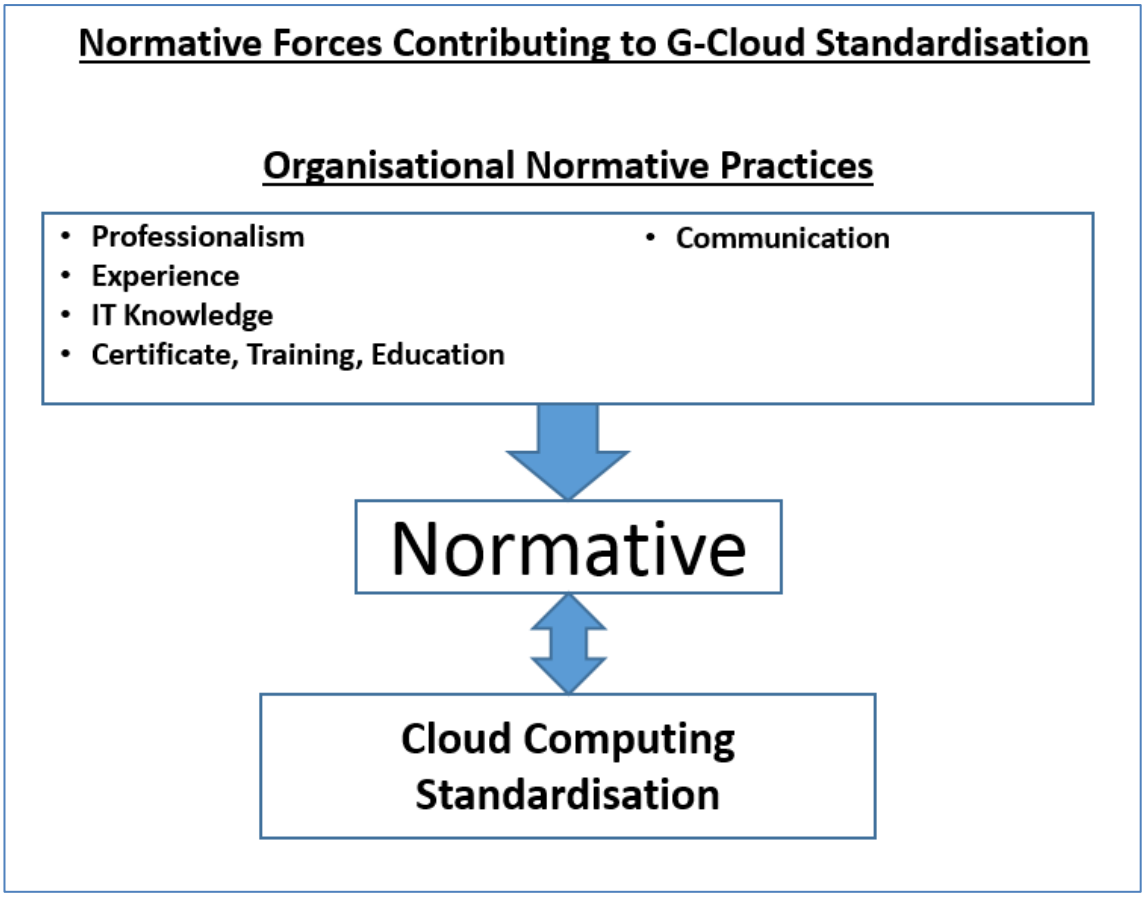

Figure 7-4: Normative organisational practices that led to standardisation

Some studies showed that the role of professionals could lead to failures in achieving organisational change (Currie 2012). For example, Currie showed how the NCRS of the NHS failed to achieve legitimacy with many medical professionals, which resulted in its failure to diffuse across the patient community. The failure was due to the policymakers excluding patients from the decision-making process for the NCRS. The implementation of National G-Cloud Programme did not result in the failure of project implementations. However, the role of professionals and normative practices had little effect on implementation of the G-Cloud.

While the ITA imposed its standards, several government agencies resisted some of these and negotiated to make sure that their projects could be completed while retaining their own standards and their way of viewing the user-friendliness of the system. For example, the MoH portal team had issues with security standards that delayed putting many modules online. The MoH pushed the G-Cloud team to bypass these security blocks so they could go live first and solve the security issues later. The attempts of the MoH to maintain their own security standards show their resistance to accepting ITA standards.

Moreover, the eOman portal team rejected the SaaS application from G-Cloud as they had been trained and had a good knowledge of their current application. This shows the resistance of these organisations to accepting standards which they felt were difficult to implement and could affect the use of the system.

The above discussion of normative mechanisms clearly shows that the normative organisational practices of professionals contributed to their resistance to the ITA's standards for the G-Cloud. They tried to negotiate these standards. However, the coercive and mimetic forces were stronger, and normative forces did not result in changes to standards or delay of the project.

7.3. Implications of the Findings

This section has addressed the implications of the findings. It started by discussing the implications of the findings of this study and then examined the implications of this study for information infrastructure research. It then highlighted the implications of this study for IS in intervention studies.

7.3.1. Implication of the Information Infrastructure Research

Scholars have studied information infrastructure from different perspectives. Some scholars have looked at it from the perspective of design and standards (Hanseth et al. 2006; Pipek et al. 2009; Star et al. 1996), while others have looked at it from the perspective of the local versus the global approach (Ribes et al. 2009; Ure et al. 2009). Establishing and enforcing standards is an important theme in information infrastructure, and these standards are not ready made; they are inscribed and involve socio-technical complexities (Hanseth et al. 1997). Overall, most of these studies investigated information infrastructure from the micro-level and neglected the macro level, especially when investigating large-scale projects. This study investigated information infrastructure implementation at the macro level using institutional theory. This perspective has been overlooked by information infrastructure research (Iannacci 2010). There are also calls inviting IS researchers to engage with institutional theory, as it is conceptually rich and more suited to the examination of complex social phenomena

(Currie 2009). Adopting a macro perspective provided a complementary lens to investigate the role of institutional theory in the implementation of information infrastructure. More specifically, this study looked at the role of the coercive, mimetic and normative institutional forces in achieving information infrastructure standardisation in government.

Currie (2012) study of institutional forces and change reinforced previous arguments (Currie 2004; Currie et al. 2007; Swanson et al. 1997); however, organisation-level innovation struggled to diffuse the large IT solution and failed to obtain legitimacy with a large section of professionals. These previous arguments held that innovation might fail to become institutionalised regardless of its potential to change the working practice of normative forces (Currie 2004; Currie et al. 2007; Swanson et al. 1997). By adopting the institutional forces in information infrastructure research, this study explored how these forces influence standards implementation in information infrastructure projects. It shows that two institutional forces, the coercive and mimetic forces, are enough to achieve standardisation. When the coercive and mimetic forces are strong, the normative force will not result in the failure of the large-scale information infrastructure implementation in government.

The findings of this study show that the four government agencies were encouraged by the market rhetoric of cloud computing to solve IT complexities and save costs. This suggests that market rhetoric as a mimetic force could drive organisations and influence actors to believe in the importance of implementing cloud computing. These findings are interesting, as they adopt an argument base that differs from previous information infrastructure research that emphasised the negotiating and contesting of standards and ultimately, resistance to their implementation (Hanseth and Lyytinen 2010; Sahay et al. 2009).

The literature shows evidence of the problems and failures of centralised control in public sector infrastructure development from the top-down (Adler-Milstein et al. 2008; Currie and Guah 2007). This study shows that implementing the G-Cloud as an information infrastructure that comes with standards from a national government can overcome the problems and failures faced earlier by the central government bodies. It has explored the way that a national government used the G-Cloud as a method to impose its standards on different government agencies. By using an implementation case study that involves a G-

Cloud infrastructure implementation, this study provides empirical evidence that these technologies through institutional forces can overcome the challenges faced by government agencies trying to implement information infrastructure.

Finally, the implications of adopting institutional theory and particularly the institutional forces in information infrastructure were significant, as it provided a different view of how information infrastructure can be implemented. It also showed that the three institutional forces play different roles, some of which are critical while others can be overlooked in the standardisation of information infrastructure.

7.3.2. Implications of Cloud Computing Research

Early cloud computing studies focused on its technical aspects, particularly in the area of grid computing and virtualisation (Foster et al. 2008). These studies were also descriptive by explaining the services, offerings, business benefits, and challenges of cloud computing (Buyya et al. 2010; Creeger 2009; Youseff et al. 2008) and did not address how cloud computing might change the way organisations implement IaaS solutions. Similarly, other studies focused on describing the cloud rather than providing in-depth analysis of how it might affect the business environment or individual users (Giniat 2011; Marston et al. 2011; Petkovic 2010). Recent studies of cloud computing explored the factors that contribute to the success of cloud computing implementation (Choudhary et al. 2013; Güner et al. 2014; Li et al. 2012). Although these studies were important in exploring the area of cloud computing implementation, they missed growing concerns about how and why this technology evolves or becomes successful in different settings. To address these concerns, this study conducted an interpretive study that investigated in depth and provides a comprehensive view of the role of institutional forces in the implementation of cloud computing in government. Conducting an interpretive case study adds to an area of cloud computing studies in which few research have used a qualitative interpretive approach (Melin et al. 2014). Additionally, studying the implementation of cloud computing at the national level in a developing country, specifically a GCC country, enriches the cloud computing literature.

Studies show that cloud computing as a disruptive technology is changing the way organisation implement information infrastructure, and the market rhetoric of technology

adoption and implementation is in agreement with these research findings (Gratner 2014). Studies have considered cloud computing as a new form of information infrastructure that is disrupting how organisation implement large IT systems (Bhat 2013; Choudhary et al. 2013) and having radical effects on industries and their boundaries (Tilson et al. 2010b). The implications of this study of cloud computing literature come from the market rhetoric of cloud computing and the use of interpretive studies to explore government implementations using a disruptive technology such as cloud computing. Reports show that cloud computing initiatives have been introduced by various national governments to take advantage of what this technology offers. These include the UK, Australian, Malaysian and Turkish governments (KPMG 2012). The reports show that cloud computing is solving many government information infrastructure implementation complexities. Consistent with these reports, this study confirms that national governments' adoption of cloud computing infrastructure can be a solution to many of the previous complexities faced by these governments in implementing information infrastructure projects.

Overall, the findings confirmed that cloud computing could be a disruptive technology that changes the way government organisations implement IS and, in particular, information infrastructure solutions. The findings show that the IaaS type of cloud computing allows government agencies to share a common information infrastructure, contributing to a standardisation of government agencies' e-portals that was not possible in the past. For example, Oman's ITA was successful in achieving standardisation in the G-Cloud initiative, while it could not implement information infrastructure standards in previous large government projects. The findings show that the mimetic forces contributed to the standardisation of the G-Cloud and moving the government agencies' e-portals to the G-Cloud. The findings also show that government agencies had heard success stories about cloud computing implementation from other organisations and other countries, and this encouraged them to accept the standards of the G-Cloud. The coercive forces of organisational top-down management contributed heavily to the implementation of the G-Cloud and the standardisation that came with it. It could, therefore, be argued that the top-down approach is a good way to implement large-scale G-Cloud. It is clear that institutional forces play a significant role in G-Cloud implementation and the standardisation of government agencies' e-portals in the G-Cloud.

The G-Cloud is a solution that can be implemented from the top down, and this is a different way of helping government agencies to benefit from ICT infrastructure. G-Cloud infrastructure helped the government agencies to save implementation time and costs, something that had not happened before.

7.3.3. Implications on Intervention Studies

The above sections show how the institutional forces played a key role in the implementation of e-portals into the G-Cloud. An important concept from the literature review is institutional intervention as a mechanism to achieve information infrastructure standardisation. Literature that addresses institution intervention draws mainly on the framework proposed introduced by King et al. (1994). This study views the institution as a social entity that applies control and influences the conduct of social agents. It argues that institutions can legislate to create motivations for innovations and encourage the accessibility of knowledge and expertise that are essential to increase the production and availability of innovations (supply-push) and influence potential users to adopt them (demand-pull). This study recognises national government agencies as one of the government authorities that influence IT innovation through intervention. Other studies have adopted the framework of King et al. (1994) and examined government intervention in different countries (McGrath et al. 2010; Silva et al. 2002).

Previous information infrastructure research looked at micro-practices and the technical issues of implementations, overlooking institutional intervention. This study shows that institutional intervention played an important role in Oman, and hence intervention is required, and institutions should be thinking of ways to intervene in IT implementation. Institutional forces contradict one another, as was shown in the case study of the National G-Cloud Programme in Oman. However, the intervention was successful because the coercive and mimetic forces overpowered the normative forces. This was not the case in other studies, such as Currie's (2012) National Health Service study where the normative forces of clinicians were very strong. This is the main difference between this case study and other studies where intuitional intervention was intertwined with factors such as the influence of professionals in the organisations and power of the unions.

Although previous research has argued that institutional forces work in harmony, this study found that if two of these, the coercive and mimetic forces, are strong, project implementation can be managed better than if all three forces are strong.

This study contributes to the institutional intervention perspective and the framework proposed by King et al. (1994). The framework identified knowledge building and knowledge deployment as the essential components of any intervention by an institution that needs to initiate ICT innovation. The perspective of King's framework is that institutional intervention is about building and disseminating knowledge in an institution. In this research, the intervention came from institutional forces, and this offers a fast and effective solution for government agencies for government agencies that lack digital infrastructure and are unable to adopt information infrastructure standardisation. Intervention is also a practical solution for government agencies that lack sufficient knowledge of IT infrastructure and cloud computing. The forces have policies, rules, and a clear framework for implementation, and at the same time, these forces encourage people by letting them understand their mimetic aspects. Utilising the mimetic institutional force to motivate implementation of the G-Cloud can be achieved by ensuring that government agencies understand that other countries and other government organisations are implementing it, and there is no reason why they cannot do the same. Whatever issues they are facing have already been overcome by other organisations, and they could and should learn from the example of others. The mimetic force encouraged the people in the government agencies studied to accept standards and change.

This study shows that intervention can happen in different ways. The National G-Cloud Programme in Oman showed that intervention is possible without the need for the users or the government agencies to acquire, build and deploy knowledge as proposed by King et al. (1994). The staff in all four government agencies became stressed and asked for training because they did not know enough about how the G-Cloud operates. Despite this, all their e-portals were implemented in the G-Cloud. This is a very successful outcome, particularly compared with many previous government implementation projects in Oman. The ITA's coercive practices contributed to successful project implementation. It used its stakeholder power, financial control, regulations and other organisational practices to achieve successful implementation and embed its standards into the government agencies e-portals. Implementation of standards challenged previous national government IT projects. Cloud computing is an emerging and potentially disruptive technology that

changes the way organisations implement information infrastructure. The market rhetoric about cloud computing can be true, and the G-Cloud can be a good approach to overcome the many complexities that are usually associated with information infrastructure implementation.

The G-Cloud is unlike other technology that allows for organic implementation. The G-Cloud solution cannot come from a bottom-up approach; it should come from the top down. It is not like many other IT solutions in government, such as the ERP solution that comes in modules and can be progressively implemented over time. The G-Cloud solution is a large infrastructure that requires government agencies to sign contracts and agree for their e-portals be implemented in it. They must also accept the standardisation that comes from the top.

7.4. Conclusion

This chapter discussed the main themes that emerged from the case study and analysis chapters. It started by discussing the role the different institutional forces played in the G-Cloud implementations. The next section discussed the findings of cloud computing and information infrastructure research, IS intervention studies, and institutional theory. The chapter then discussed and reflected on the findings of the case study. It offered a framework that shows how institutional forces led to G-Cloud implementation and identified the different organisational practices associated with the institutional forces in G-Cloud implementation in Oman. The discussion led to the conclusion that coercive and mimetic institutional forces contributed to successful implementation of Oman's National G-Cloud Programme despite the normative forces that worked in against it.

8. Chapter Eight: Conclusion

8.1. Introduction

This chapter provides a summary of the research that has culminated in this thesis. The chapter begins with an overall summary of the research in section 8.2. It then presents (in section 8.3) the research contribution to theory and practice. Section 8.4 acknowledges the research limitations and section 8.5 offers directions for future research. The chapter ends with a final summary in section 8.6.

8.2. Research Summary

The objective of this section is to provide a summary of the previous chapters of this thesis. The summary will give the reader a general idea of the flow of this study and how it reached the discussion chapter.

In response to citizens' continued pressure on their governments to improve the level of service provided by the different government agencies, governments started implementing IS solutions. However, the government agencies faced many challenges that hindered the implementation of IS projects. Information infrastructure is one of the main areas where the different government agencies face issues and challenges. One of the critical challenges of information infrastructure is the application of standards and standardisation. This study argues that institutional forces can play an important role in implementing national information infrastructure initiatives. More specifically, it argues that the different institutional coercive, mimetic and normative forces can affect the application of the standards and standardisation needed for successful information infrastructure implementation.

Overall, this study asks the research questions: How do institutional forces affect the implementation of government cloud computing? and what organisational practices can lead to the adoption and implementation of cloud computing in government? It examines the Sultanate of Oman's National G-Cloud Programme implementation of Infrastructure as a Service. It adopts an institutional perspective, considering the important role that institutional context and forces play in systems adoption and implementation (Avgerou 2000; Currie et al. 2007). This point of view has recently received attention in IS

infrastructure research as it provides a macro perspective of the institutional arrangement and context that impacts on standards adoption, a perspective that has been widely overlooked in IS infrastructure research (Iannacci 2010). It also responds to calls for IS researchers to engage with institutional theory, which is conceptually rich and more suited to the examination of complex social phenomenon (Currie 2009). The following summaries of the different chapters describe how the research questions were addressed.

Chapter one provided an introductory overview of the research. It offered a brief research background, identified the research problem, outlined the motivations for conducting this research, and described its significance and relevance. It started by discussing the importance of information infrastructure research in IS studies. It showed how research into IS has revealed significant challenges when implementing large-scale complex systems and exposed the existing weak theoretical understanding of these types of large systems or information infrastructure (Tilson et al. 2010b). With the recent wave of digitisation and digital convergence and the introduction of cloud computing solutions, the call to revisit previous assumptions has become more imperative to help strengthen theoretical understandings. Chapter one then presented the layout of this research and the significance of this study.

Chapter two, the literature review, gave a critical review of the literature addressing IS implementation in government, cloud computing research, and information infrastructure. The objective of this chapter was to identify gaps in the research and explain the understanding that was used in crafting the theoretical framework presented in chapter three.

The first area reviewed was IS implementation in government. This section discussed the different areas of research that have been explored in IS government studies. Examples of these are in health services (Aanestad & Jensen 2011, Braa et al. 2007, Jensen et al. 2009), national government studies (Cats-Baril & Jelassi 1994, Chan & Pan 2008), and government services through IT (Chan et al. 2011, Chan et al. 2008, Moon 2002). It showed that the number of studies related to IS implementation by the government has increased with the introduction of the internet and the availability of online services (Chen et al. 2007). In addition to this, the provision of online services by private companies has pressured national governments to provide more e-services to their citizens and business sectors. The section then discussed how the initiation of IS implementation processes in

government had produced difficulties and challenges. These challenges were mainly in the areas of system design, integration, work process, communication, coordination, culture, and authority structure (Fountain 2001). The section then asserted the need to revisit government implementation studies to investigate recent forms of technology infrastructure, such as cloud computing, that is being adopted or implemented by some governments. It is possible that the issues and challenges previously associated with government implementation of IT systems can be overcome by implementing the more recently developed cloud computing infrastructure.

In the cloud computing literature review section, the study first explained the concept of cloud computing by identifying the benefits of the solution, the different types of the solution, and the services cloud computing offers. The section then discussed the literature of cloud computing and the main themes that emerged from this literature. The literature review showed that cloud computing studies could be categorised as technology-related studies such as grid computing and virtualisation (Foster et al. 2008; Vecchiola et al. 2009) and studies that discuss the benefits and impact of cloud computing in different settings (Bhat 2013; Bhattacherjee et al. 2014). Other studies have described the type of services and offerings and the business benefits of the cloud (Buyya et al. 2010; Creeger 2009; Youseff et al. 2008). There are also studies that investigated the business values of cloud computing, viewing it from various perspectives (Bhat 2013; Hoberg et al. 2012). The section showed how the cloud computing literature helped to identify the different factors that contribute to the success of implementation. However, the studies overlook issues of how and why this technology is influencing IS implementation in organisations. The literature review identified the importance of investigating cloud computing from an interpretive perspective. It also showed that interpretive research related to cloud computing is limited (Melin et al. 2014), and there are few if any studies that explore IaaS cloud computing by national governments using institutional forces. The section concluded that investigating a national cloud computing implementation in the government sector where different government agencies (multiple sites) are implementing their application in a national IaaS is an important gap to be studied.

The last section of chapter two explored the literature on information infrastructure by looking at how researchers have conceptualised this area of IS. The section showed that

earlier studies of information infrastructure tended to focus on how to conceptualise information infrastructure (Monteiro et al. 2014). These studies conceptualised different topics in information infrastructure such as design (Pipek et al. 2009; Star et al. 1996) and standards (Hanseth et al. 2006; Hanseth et al. 1997). Some studies attempted to conceptualise information infrastructure based on contrasts between the local and the global (Ribes et al. 2009; Ure et al. 2009) and between system design and implementation (Braa et al. 2007). The section then identified recent information infrastructure studies that go beyond snapshots of particular moments in information infrastructure development. These studies involved with multiple moments and long-term trends. The section then explored information infrastructure standards implementation by identifying the different issues related to standards such as control (Hanseth et al. 1996), flexibility (Bekkers 2009; Hanseth et al. 2006), evolution (Henfridsson et al. 2013), design (Hanseth et al. 2003; Nielsen et al. 2006), and bootstrapping (Hanseth et al. 2010). Finally, this section identified the research gap by showing that many studies have investigated information infrastructure implementation challenges, but most of these addressed the technical aspects of information infrastructure development, such as data standards and standardisation procedures. Less attention was given to institutional perspectives (Iannacci 2010). Studying information infrastructure from an institutional perspective is an important contribution in this area, as there is limited systematic consideration of the influence of the institutional perspective or the broader context of the form and dynamics of information infrastructure, even though such an assessment would have immediate implications for information infrastructure policies. The literature showed that studies using institutional theory in the IS field had generated criticism from the IS community, as they are conceptually rich but empirically impoverished (Hasselbladh et al. 2000). Therefore, studies that apply institutional theory empirically will be a valuable contribution to the IS literature, particularly in the area of information infrastructure.

The literature review also explored recent studies that looked at theoretical, methodological, and practical outcomes where information infrastructure has been used as a tool of analysis, or more specifically, as a guideline for intervention (Monteiro et al. 2014). Although these studies explained the role of information infrastructure as a guideline for intervention, it is important to explore how information infrastructure systems such as IaaS have been used as a tool for intervention in different sites. For example, while allowing the users to benefit from IaaS, national governments are

imposing their standards and rules on users in different locations and different socio-technical settings.

The literature review section then considered how cloud computing could be seen as a new wave of digitisation and a new form of infrastructure technology that disrupts our knowledge of systems implementation and infrastructure complexity (Bhat 2013; Choudhary et al. 2013). It also showed how cloud computing provides an alternative method of hosting IT services and allows for standard uniform services for the entire organisation. The chapter discussed the market perspective of cloud computing and how it offers a solution for many organisations to obtain IT services faster and more cost-effectively with shorter implementation times (Gratner 2014). The literature also suggests that the reported success stories of adopting a standard information infrastructure contrast sharply with the accumulated knowledge of IS implementation and IS infrastructure implementation (Hanseth et al. 2010; Hanseth et al. 1997; Hanseth et al. 1996; Star et al. 1994). Hence, examining how the new wave of cloud computing IS infrastructure is being implemented is a gap that needs to be filled. Additionally, this examination could offer a fresh perspective on the implementation of standard IS infrastructure. It could also help government agencies to achieve their objectives through technology implementations and avoid implementation complexities.

The theoretical framework chapter, chapter three, aimed to review the institutional isomorphic mechanisms and used these mechanisms as a theoretical lens to understand the case study. The chapter provided the justification for using institutional theory for this study. It started by reviewing institutional theory in general and the importance of using institutional isomorphism for this research. It explained the concept of institutional theory and the identifying the two key concepts in management studies which are institutions and organisations. It examined the difference between the old and the new institutionalism and discussed the different new institutionalism flavours. The final section discussed the isomorphic mechanism (institutional forces) as the research focus of this study. Institutional theory looks at the different aspects of organisations by examining three types of mechanisms: the coercive, normative and mimetic forces (DiMaggio and Powell, 1983; Tolbert, 1985).

The chapter then explained how the institutional theory was used in IS studies in government. It also explored how researchers used the three isomorphic mechanisms or

institutional forces in studying IS in Government. The next section of chapter three discussed the application of institutional theory to information infrastructure studies and noted several studies that have used this approach (Brown et al. 2011; Hanseth et al. 1998; Iannacci 2010). The literature contains studies in information infrastructure that adopted institutional theory to study national government projects; however, there are few (if any) studies that explore how the isomorphic mechanisms influence information infrastructure implementation. The literature addresses the importance of considering new phenomena, such as a centralised IaaS implementation with set standards, and how these standards are institutionalised on the users. The next section identified different organisational practices and associated these practices with the coercive, normative and mimetic institutional forces. It showed how these mechanisms are identified with organisations and the practices that researchers can associate with a particular isomorphic mechanism. It then proposed a model to interpret and analyse the case study. The last section of chapter three discussed the limitations of institutional theory, one of which is the scant attention it gives to human agency.

The research methodology chapter, chapter four, explained the method adopted by this research. The study adopted a qualitative interpretive approach, which allows for in-depth exploration of social and cultural phenomena (Myers 2010). The chapter started with the research paradigm by identifying the different paradigms used in research and the rationale for choosing the interpretive research approach. The next section discussed the research philosophy, and then explained the reasons for selecting the qualitative research approach. Different research strategies were discussed, and then the rationale for selecting the case study approach was explained. The case study approach was informed by the research questions for this case study. This research is about the institutional forces that influence information infrastructure implementation in government. Benbasat et al. (1987) identified the case study approach as a well-established method to study and analyse IS data. Cassell and Symon (2004) described case strategy research as the detailed exploration of data collected over different periods in their own context. This approach is well suited to the research questions, which require a detailed understanding of processes in the context of the rich information they offer. The next section showed the level of analysis of this research; this is the national level, as the case study was of the national government of Oman's implementation of its National G-Cloud project. Different government entities are utilising the government cloud or are in the process of moving to

it. This study used an embedded (multiple units of analysis) single case type of case study (Yin 2014). It involved an embedded agency as a user of the government cloud. In the embedded unit, various organisational practices are identified against the isomorphic mechanisms.

The case study chapter, chapter five, provided a descriptive explanation of the case study of this research. The case study covers the implementation stage of the National G-Cloud Programme in Oman. This programme involves the adoption and implementation of the G-Cloud of the e-portals of various government agencies. For this case study, four different embedded government projects were investigated and discussed. The chapter starts by describing the country and the organisation in which this research was conducted to provide a better understanding of factors that influenced the implementation.

Chapter six, the analysis chapter, discussed the research findings. It started by discussing the findings of the practices that resulted in the standardisation of G-cloud computing implementation by the ITA. It then discussed the dynamics of how to achieve standardisation across all the government agencies. Four embedded case studies were conducted to discover how the isomorphic mechanism leads to standardisation. The embedded case studies were of the MoH e-portal, the NCIS statistical portal, the PAMR e-portal, and the ITA eOman portal.

Chapter seven, the discussion chapter, discussed the role of institutional forces on G-Cloud implementation by providing a cross-sectional study of all four case studies and how each institutional force contributed to the standardisation of e-portals into the G-Cloud. The chapter then highlighted the implications of the findings in cloud computing research, information infrastructure research, and IS intervention research.

8.3. Research contributions

Research in IS must be rigorous and theoretically interesting (Benbasat and Zmud 1999; Rosemann and Vessey 2008). This study investigated both the implementation of information infrastructure in government and the effect of institutional forces on the implementation of Oman's National G-Cloud Programme. This section outlines the study's theoretical and practical contributions.

8.3.1. Contribution to the theory

This study's findings make several contributions to the IS field in general and, more specifically, to the study of information infrastructure, cloud computing, and institutional theory in IS. The following subsections identify the theoretical contributions to these areas.

8.3.1.1. Contribution to Information Infrastructure research

This study contributes to existing theory in the area of information infrastructure by investigating the implementation of cloud computing through the lens of institutional theory. There are few previous studies of information infrastructure implementation at the macro level (Brown and Thompson 2011; Hanseth and Monteiro 1998; Iannacci 2010). Adopting the institutional perspective is important in view of the role that institutional forces play in information infrastructure implementation (Avgerou 2000; Currie and Guah 2007). This perspective has recently been recommended for information infrastructure research because it provides a macro perspective on the institutional arrangement and the contexts that impact the adoption and implementation of standards that have been largely overlooked by researchers (Iannacci 2010).

Adopting a macro level perspective of the adoption and implementation of information infrastructure allowed this research to contribute to the area of information infrastructure. The adoption and implementation of standards in information infrastructure are thought to be complicated and difficult to achieve (Aanestad et al. 2011; Star et al. 1994). (Sahay et al. 2009) proposed that information infrastructure usually evolve in an incremental way through partly planned and unplanned processes. They argued that failures of system integration contribute to the lack of evolution of the infrastructure. This study, however, proposes that top-down adoption and implementation is possible through the institutional approach and through recent emerging information infrastructure implementation such as the cloud computing.

Recent studies addressing institutional forces did not focus on organisational practices (Hsu et al. 2015; Kurnia et al. 2015; Sharma et al. 2016; Sherer et al. 2016). For Example, (Hsu et al. 2015) study related to the adoption and diffusion of a cross-cultural interorganisational. It explored the three institutional forces through its dependency across different countries and the deployment of legitimation strategies by stakeholders. Another study explored the adoption of ERP by a medium sized Indian

firm and explored in detail the factors and institutional forces affecting this in an Indian context. These studies did not consider organisation practices and their relationships with institutional theory.

Similarly, recent studies investigating information infrastructure implementation have not addressed the role of institutional interventions (Akbar et al. 2015; Bygstad et al. 2017; Kurnia et al. 2015; Nambisan et al. 2017). For example, Bygstad et al. (2017) studied a process innovation initiative and its successful interaction with digital infrastructure. This study contributed to information infrastructure research by proposing a configuration for effective process innovation in a large, complex e-health context in in Norway. Another recent study by Nambisan et al. (2017) aimed to offer a wider foundation for reinventing innovation management research in a digital world. aimed to offer a wider foundation for reinventing innovation management research in a digital world. Their broadly defined objective was to bridge research focused on intra-organizational innovation management (e.g., Swanson 1994) with other research including information infrastructure studies (Tilson et al. 2010b).

8.3.1.2. Contribution to Cloud Computing research

The study contributes to the area of cloud computing by investigating the adoption and implementation of cloud computing in government. It describes qualitative, interpretive, and empirical research into cloud computing, an area in which there is a dearth of previous research. This study empirically investigates the market rhetoric of cloud computing that promises simple and straightforward adoption and implementation of standards.

Studying cloud computing from the information infrastructure perspective makes a contribution by investigating an emerging type of information infrastructure. This type of information infrastructure allows a central organisation to redistribute control away from the owners of the physical assets (internal systems) in organisations. This redistribution became possible with the expansion of bandwidth that has allowed the adoption and implementation of service innovation in the public sector (Bygstad et al. 2007). Bandwidth growth and cloud computing services have allowed organisations and government agencies to recreate services and avoid previous socio-technical complexities. These solutions resulted in outcomes that were not achievable by previous implementations. Studying cloud computing as a new wave of digitisation by empirically

testing a G-Cloud adoption and implementation adds to the literature of cloud computing. The study also contributes to the cloud computing literature by investigating the effect of institutional forces on the adoption and implementation of cloud computing in government.

8.3.1.3. Contribution to Institutional Theory in IS

The study contributes to institutional theory in IS by providing a comprehensive understanding of how various institutional forces impact information infrastructure. It identifies three institutional forces that play different roles in the implementation process. The findings indicate that not all the forces need to be strong; the mimetic and coercive forces alone are sufficient to achieve standardisation of G-Cloud. Although some aspects of normative forces resisted this standardisation, this did not influence implementation of the standards. Through an in-depth case study of Oman's national G-Cloud implementation programme, this study offers a comprehensive overview of the role of the three institutional forces in the implementation of information infrastructure.

The study also contributes to the understanding of the institutional role of information infrastructure, a phenomenon that has not been sufficiently addressed. Little has been published about the role of institutions in information infrastructure implementation. Previous research on institutional theory as it relates to information infrastructure has not identified a gap in the approach of central bodies to implementing national standards (Brown and Thompson 2011; Iannacci 2010).

In response to scholars who call for institutional theory to develop a broader empirical base in which the ideas are more closely related to real-world situations, this study provides empirical evidence of the important role of institutional theory in explaining Oman's experience of implementing cloud computing. It provides empirical evidence that in order to achieve information infrastructure standardisation, it is not required that all institutional forces work together. It shows that two institutional forces are sufficient to achieve standardisation. More specifically, this study argues that when there are very strong coercive and mimetic forces, the normative force will not have any significant negative influence on large-scale IT implementation in government.

This study also contributes to theory by identifying the organisational practices that develop from each of the institutional forces. Based on these practices, the study interprets the effect of the institutional forces on the implementation of information infrastructure

initiatives. The theoretical framework presented in this study examines the different organisational practices from the literature and relates them to the various institutional forces. These institutional forces can lead to the standardisation of cloud computing. The framework is modified on the basis of the case study presented, and it identifies the various organisational practices and how they have contributed to the standardisation of Oman's national G-Cloud program. By showing the dominant role of the coercive and mimetic forces in G-Cloud implementation irrespective of the normative force, this finding differs from Currie's (2012) conclusion that the normative institutional force could lead to the failure of IS projects. Currie's (2012) study built on research that argued that new institutional logics emerging from the coercive, mimetic and normative forces are likely to come into conflict with existing institutional logics. This conflict produces a scenario in which a new innovation may fail to become institutionalised regardless of its potential to change working practices (Currie 2004; Currie and Guah 2007; Swanson and Ramiller 1997).

8.3.2. Contribution to Practice

The findings of this study and their implications make important contributions to practice. Although government organisations have previously invested in IT infrastructure projects, many of these failed to achieve their objectives or were only delivered after long delays. This study provides government decision makers with useful insights into how institutional forces can help to achieve the implementation of new forms of information infrastructure solutions, such as cloud computing.

The conceptual framework also provides general guidelines for IS practitioners in the government sector to know and understand the organisational practices that are identified as facilitating standardisation. Although the organisational practices were studied in relation to Oman's National G-Cloud Programme, they can be a useful guideline for other national governments contemplating cloud computing projects and for central organisations interested in implementing large information infrastructure.

The study's findings that in practice the mimetic and coercive forces can overcome the normative force's resistance to standardisation offer a speedy, effective strategy for governments who seek to implement information infrastructure solutions. This can overcome the need for knowledge transfer to government agencies, as the knowledge can be acquired externally, and implementations can be achieved.

Other national governments with structures similar to Oman's, particularly GCC countries, who are contemplating a similar approach to implementation should consider how the ITA was able to actively encourage government agencies to adopt standards they were unwilling to accept before. At the same time, national governments should be aware of the normative organisational practices that contested or rejected the standardisations in the study. Acknowledging these practices will allow central governments to reduce the level of normative organisational practices which led to resistance.

Government agencies who are planning to benefit from the National G-Cloud Programme should understand the benefits and the drawbacks that they gain from hosting their application in the G-Cloud and accepting the standards that come with it. The implementations of the four projects discussed in this study will allow other government agencies to learn from their experience. Government agencies should also consider the organisational practices discussed in this case study that led some agencies to contest or reject parts of the standards. The practices that resulted in government agencies rejecting standardisation can provide food for thought for other government agencies who are interested in joining the G-Cloud. This might allow them to negotiate some standards while they are in the comprehension and adoption stages of the innovation process (Swanson et al. 1997). The power to negotiate standards will be minimal once government agencies reach the implementation stage, as by then the G-Cloud standards are difficult to change.

It would be valuable to know if the findings of previous researchers about the implementation challenges of information infrastructure are taken into account by organisations. Researchers and practitioners should know if cloud computing is solving these issues and challenges. The findings of information infrastructure research and e-government studies should become more integrated. Studies of e-government have focused more on issues of governance, policies, and citizen involvements, while few studies have considered information infrastructure and e-government literature together (Bekkers 2009; Brown et al. 2011).

8.4. Research limitations

Although this research provides novel and important new insights and draws valuable conclusions about information infrastructure implementation in government, its limitations are worth noting because they may suggest fruitful avenues for future research.

First, this study focuses on the implementation aspects of information infrastructure. It considers that implementation of government agencies' e-portals to the G-Cloud is successful as long as these e-portals are live and used. Although the government agencies' e-portals were live and running in the G-could immediately after implementation, this study could not explore the use of these portals after implementation. Studying this would require a different research approach and possibly a longitudinal study.

Second, only the IaaS type of cloud computing service and the standards integrated with it were studied by this research. Other services, such as PaaS and SaaS, were not explored, as implementation of the G-Cloud was still in its early stage. At the time of this research, the National G-Cloud Programme was in the first stage of development and targeted only selected government agencies. The G-Cloud programme is an ongoing project that aims to benefit a wider range of government agencies by supporting the development their IT services.

Third, this research was limited to Oman and only studied the government sector in that country. Although the research context is quite specific, it is believed that this context can be generalised to other GCC countries whose demographics are similar. Other countries can also learn from this experience of implementation, with the proviso that the conditions and circumstance of other countries will differ.

Fourth, this research was conducted within a specific period, and its research methodology necessarily took the nature of a snapshot. The study does not consider the influence of institutional forces on information infrastructure implementation over time.

In this case study, the demographics of Oman may be a factor influencing the strength of the normative force. The population of Oman consist of around 55% of Omani nationals and 45% non-nationals. This may explain why individuals, groups, and organisation accept government directions without contesting them, and why the coercive forces heavily outweighed the normative forces. This may not apply in countries with different demographics. It should, however, be noted that in Dubai, Alghatam et al. (2012) found

that professionals accepted direction and did not resist the implementation of e-government. The case study by Lyytinen et al. (2009) of a Saudi steel company showed similar results. This is in contrast to Currie's (2012) study of normative forces in the NHS implementation programme. Non-GCC countries may learn from Oman's experience of implementation, with the proviso that the conditions and circumstance of other countries will differ.

8.5. Future research

This study lays the ground for several future studies. It focused only on the IaaS type of cloud computing. Future research could explore other types of services, such as PaaS and SaaS, and explore government agencies' implementation issues using these services. It would be interesting to investigate, for example, if and how institutional forces have affected the standardisation of SaaS solutions. Although IaaS comes with standards, other and higher layers of cloud computing have more standards that need to be accepted by users. Establishing a common e-portal in the G-Cloud is one of the expected solutions for government agencies. Studying this would further contribute towards the understanding of how government agencies accept greater standardisation that changes the way they work.

Future research could also study the effect of the institutional forces on cloud computing implementation in developed countries. Another and possibly related area that needs study is the influence of national culture on the acceptance of information infrastructure standards.

Future studies could investigate the coordinative and communicative issues that occur between organisations while implementing information infrastructure (Kromidha et al. 2017). For example, a future study could examine the coordination and communication issues between the ITA, who control the G-Cloud in Oman, and the government agencies who implement their systems into the G-Cloud. This might identify challenges caused by a lack of coordination and communication.

Future information infrastructure researchers are also invited to examine further the role of market rhetoric and mimetic forces in implementing cloud computing and other sectors.

Finally, future research is recommended to consider longitudinal studies. For example, why and how do institutional forces interplay in G-Cloud implementation as governments and government policies and priorities change over time? Such longitudinal studies may improve the robustness of the results presented in this study.

8.6. Conclusion

This concluding chapter started by providing an overall summary of the research. It then addressed the research's contribution to both theory and practice. The last two sections considered the research limitations and the future research contributions.

Studying the National G-Cloud Programme in Oman has contributed to the areas of cloud computing and information infrastructure. It is hoped that results of this research will not only add to theoretical understandings but, more than this, be of direct practical value. It is also hoped that this research encourages and provides a sound basis for future productive work to probe more deeply into this growing and interesting area of research.

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Appendices

Appendix A: Acronyms

	Name	Description
1	CRM	Customer Relationship Management
2	CSA	Cloud Security Alliance
3	DGIT	Director General of Information Technology
4	DI	Discursive Institutionalism
5	DOI	Diffusion of Innovation
6	e-Oman	Oman e-government portal
7	e-Portal	A government agency's electronic portal
8	G-Cloud	The Government's cloud computing infrastructure
9	Government Agency	The government agencies implementing their e-portals in the G-Cloud
10	HI	Historical Institutionalism
11	IaaS	Infrastructure As a Service
12	Information Infrastructure	Also represents Large IT systems, Digital Infrastructure, Large IT Infrastructure.
13	Institutional Forces	Institutional Isomorphic Mechanisms
14	IS	Information Systems

15	ISD	Information Security Division
16	IT System, IT application	The Application being developed by government agencies
17	ITA	Information Technology Authority
18	MOC	Ministry of Commerce
19	MOH	Ministry of Health
20	MPLS	Multi-Protocol Label Switching
21	NCSI	National Centre for Statistics and Information
22	NIST	National Institute of Standards and Technology
23	ODP	Oman Data Park
24	OGN	Oman Government Network
25	OSI	Open Systems Interconnection
26	PaaS	Platform As a Service
27	PAMR	Public Authority for Manpower Register
28	PKI	Public Key Infrastructure
29	RFP	Requests For Proposals
30	RI	Rational Choices Institutionalism
31	ROP	Royal Oman Police
32	SaaS	Software As a Service
33	SI	Sociological Institutionalism
34	TEF	Technology Enactment Framework
35	The G-Cloud Project	The Government cloud computing project

36	The National Programme of Government Cloud in Oman	A programme which was initiated by the ITA to build a Government cloud computing infrastructure to be used by Omani Government agencies.
37	Web Content Management	'Software system that provides website authoring, collaboration, and administration tools designed to allow users with little knowledge of web programming languages' (Johnston 2013).
38	IOT	Internet of Things

Appendix B: Interview Questions

1. What is the project?
2. When did it start? What are the objectives? What were the previous projects
3. Who is involved?
4. What are the stages?
5. Which stage are you in now?
6. Do you have any document to share with me? I just need more background about the project and its history.
7. What is the project about?
8. Is there a relationship with the G-Cloud project? What is its relationship with the G-Cloud? How? Why? Did you start before the G-Cloud project or after?
9. What is the G-Cloud meant to be? Cloud computing? Does the G-Cloud impact your project at all? How? Can you give me examples?
10. What is the role of the cloud vendor? Does the G-Cloud project communicate with you and your vendors? How? Why?
11. What capabilities does cloud computing have?
12. What functionalities does it include?
13. Does the cloud give you any flexibility at all? How, why, give me examples.
14. Why do you think your organization decided to use and implement the G-Cloud? Why?
15. Do you need to comply with particular standards? How? Why? Give me examples.
16. IT Health projects always have particular requirements; how easy/difficult was it to accommodate your special requirements within the G-Cloud?
17. What special requirements do you have? Can you give me examples?
18. What are you doing to implement the G-Cloud? What problems/challenges are you currently facing?
19. Does the G-Cloud create more problems for you?
20. Does the G-Cloud make any aspect of your work easier?
21. What do you think is required to implement something like the G-Cloud smoothly? Do you think any particular changes need to happen? In which areas?
    Is it easy for your vendors to deal with other vendors? How is this organised?

22. Does the implementation of the G-Cloud require training? Or is it simple? How? Which aspect?
23. How is the G-Cloud project run? Did they consult with you? Do they expect you to follow some standards? Are these standards easy to follow? How? Why? Give me some examples.

Appendix C: E-government studies and categorizations

The area of e-government has attracted the attention of researchers and practitioners alike. Some journals have published special issues that specifically focus on e-government. Some of these journals are: the Information Systems Journal (2005), the European Journal of Information Systems (2007), the Journal of Strategic Information Systems (2008), the Journal of Organisational and End User Computing (2010), the Journal of Cases on Information Systems (2011), and the DATABASE for Advances in Information Systems. There are, in fact, journals specifically dedicated to e-government (International Journal of Electronic Government Research; E-government, An International Journal; Government Information Quarterly and Electronic Journal of E-government).

With these numbers of studies on e-government, several have provided an overview of the e-government literature (Andersen et al. 2010; Heeks et al. 2007; Yildiz 2007). For Example, Heek & Bailur's (2007) emphasised five main aspects: perspectives on the impacts of e-government, research philosophy, use of theory, methodology and method, and practical recommendations. Yildiz (2007) critically analysed the development and various definitions of the e-government concept, and discussed the limitations of the concept, and the methodological and conceptual remedies of e-government. Moreover, Andersen (2010) used a conceptual framework to identify ICT impacts on four domains within the public sector—capabilities, interactions, orientations, and value distribution—by studying 55 first-hand empirical peer-reviewed journal publications during the period 2003–2009.

The term e-government, which has been used since the 1990s, has been defined as using the internet to provide government information and services to citizens (Ronaghan 2002). Other researchers, such as Fountain (2001), used terms such as digital government and virtual state to describe e-government. Fountain (2001) defined digital government as *'a government that is organized increasingly in terms of virtual agencies, cross-agency and public-private networks whose structure and capacity depend on the internet and Web.… The virtual agency, following the Web portal model used in the economy, is organized by client* (Fountain 2001).

Conversely, Means et al. (2000) defined e-government as the relationships between governments, their customers, and their suppliers by the use of electronic means.

Therefore, different writers have provided different interpretations of e-government, but most of these clearly highlight services to customer or citizens.

Researcher and institutions have categorised e-government as a relationship among various groups of interest. For example, Brown et al. (2004) broke down e-government relationships into three categories, which are: Government (G2G), Government-to-Citizen (G2C), and Government-to-Business (G2B). Yildiz (2007) included two additional categories: Government-to-Civil Societal Organisations (G2CS) and Citizen-to-Citizen (C2C) (see Table 2.1).

Parties of communication	Content	Dominant characteristics	Definition	Example
Government-to-Government (G2G)	Government information and services	Communication, coordination, standardization of information and services	E-administration	Establishing and using a common data warehouse
Government-to-Citizen (G2C)		Communication, transparency, accountability, effectiveness, efficiency, standardization of information and services, productivity	E-government	Government organization Web Sites, e-mail communication between the citizens and government officials
Government-to-Business (G2B)		Communication, collaboration, commerce	E-government, e-commerce, e-collaboration	Posting government bids on the Web, e-procurement, e-partnerships
Government-to-Civil Society Organizations (G2SC)		Communication, coordination, transparency, accountability	E-governance	Electronic communication and coordination efforts after a disaster
Citizen-to-Citizen (C2C)		Communication, coordination, transparency, accountability, grassroots organization	E-governance	Electronic discussion groups on civic issues

Table F.0-1 Subcategories of e-government relationships
Source: (Yildiz 2007)

Moreover, many articles discussed e-government categorizations and the process of e-government (Gil-Garcia et al. 2007; Layne et al. 2001; Lee et al. 2005). For example, Layne et al. (2001) proposed a four stage model focussed on functionality and technical features and the integration of e-government(Table 2.2). The model consists of four main stages: cataloguing, transaction, vertical integration, and horizontal integration (Layne et al. 2001). *Cataloguing* is the main and the first stage of e-government, and it is essential for the organization to document all the business processes that are being operated. It is also considered that the initial efforts of state governments are focused on establishing an online presence for the government. Many state governments' efforts in web development

and forms-on-line initiatives belong to this stage (Layne et al. 2001). The second stage is the *Transaction* stage, where e-government initiatives will focus on joining the internal government application with online interfaces and enabling citizens to interact with the government electronically. The third stage is *Vertical* integration, where local systems are integrated with higher level systems with similar functionalities. The last stage is *Horizontal* Integration, which is the integration across different functions and services (Layne et al. 2001). Other studies have redefined this cataloguing by adding more stages: Initial presence, Extended presence, Interactive presence, Transactional presence, Vertical integration, Horizontal integration, and Totally Integrated presence (Gil-Garcia et al. 2007). Additionally, other studies have extended the model to suit the customer-centric approach (Andersen et al. 2006), or to focus on the interoperability of system, process, knowledge, value, and goal (Gottschalk 2009). Other studies have proposed another model for specific objectives within e-government. For example, Lee et al. (2012) proposed an Open Government Maturity Model to assess and guide open government initiatives focussed on achieving one maturity level at a time.

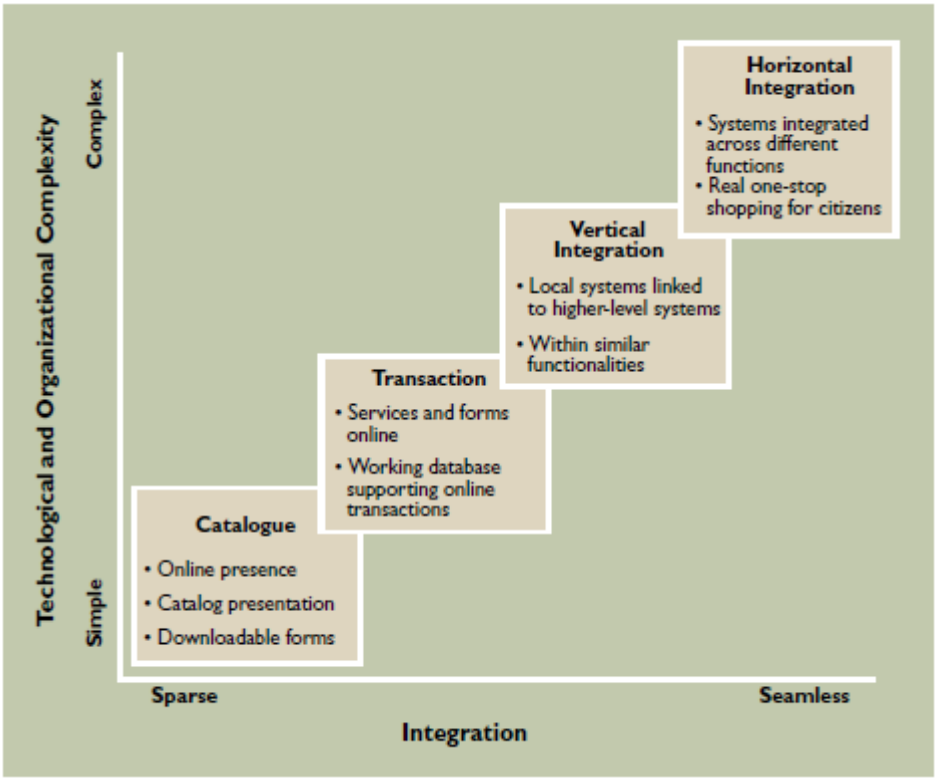


Figure F.0-1 Dimensions and stages of e-government development
Source: (Layne et al. 2001)

From the stages mentioned in table 2.2, it is noticeable that e-government initiatives can start within each government agency. These government agencies adopt and follow the stages of the e-government development model (Layne et al. 2001) to provide services to different parties through G2C, G2B, or G2G (Yildiz 2007). Many of these agencies could provide few services to the public using IS. With the advent of the internet, the public has become much more aware and demanding in terms of getting fast and better services from government agencies. These demands have pushed these agencies to focus more on the G2G communication and horizontal integration between different agencies to achieve a 'one-stop-shop', which requires the seamless communication, coordination, and standardisation of information and services between various government agencies. When considering research in e-government, it is noticeable that most of it focussed upon areas such as citizen participation and governance. Few studies, on the other hand, discussed issued related to G2G, such as establishing and using a common infrastructure data warehouse for all agencies (Klischewski et al. 2010; Realini et al. 2004) and particularly establishing a government cloud computing infrastructure (Bhat 2013). Shared infrastructure and standardisation are important components of any e-government initiative. Cloud computing is considered to be a shared infrastructure that can be a solution for many government organisations to overcome the challenges they would face in establishing an Information Infrastructure by themselves. Hence, many national governments have been motived by this emerging form of Information Infrastructure by implementing a private cloud computing Infrastructure to provide facilities for government agencies and offer services through cloud computing.

Appendix D: Other theories used in Information Infrastructure Studies

Appendix C presents the other theories used in Information Infrastructure studies. The purpose of this section is to investigate how these theories were used, what were the findings of these studies, and what was each theory's weakness.

Information Infrastructure has been studied from different theoretical perspectives. Those theories can be categorised into Actor-Network theory, Complexity theory, Relational model, Diffusion of Innovation theory, and Institutional theory. Table 1 explains the various theories that have been used in the field of information infrastructure and the findings of the studies.

#	Adopted Theory	Papers	Findings
1	**Actor-Network Theory** Callon (1986), Latour (1987)	Hanseth et al. (2006)	How efforts aimed at reducing complexity through standardisation may generate the opposite outcome, which is called reflexivity. The increased intertwining of technical standards with local, heterogeneous, and dispersed work practices are the cause of such complexity. Further research on complexity is needed.
		Hanseth et al. (1997)	How standards and standardisation Information Infrastructure can be conceptualised as actor-networks and how they stabilise larger actor networks. This study shows how all elements of a standard (viewed as an actor-network) influence user behaviours.
		Monteiro et al. (1996)	Introducing ANT to conceptualise the relationship between Information Infrastructure and Organisational issues by studying the role and pattern of the diffusion of standards. The authors argued that standard diffusion requires the coordination of the surrounding actors, institutional arrangements, and work practices.

		Fomin (2003)	Proposed an analytical technique to develop a functional connection model linking infrastructures to standards by way of functions through specific dyads—social practices and boundary objects, technology and gateways, institutional arrangements and technological fixes.
2	**Complexity theory** Holland (1995), Law (2002)	Braa et al. (2007)	Proposed the concept of flexible standards as a key element in a sustainable infrastructure development strategy.
		Hanseth et al. (2006)	Suggested a theoretical interpretation of standardisation complexity by using ideas from complexity theory and the theory of reflexive modernization
3	**Relational model** Engeström (2014) Lave et al. (1991)	Vaast et al. (2009)	Investigated the practice-based learning dynamics that occur among. Propose a trans-situated learning model.
		Armstrong et al. (1999)	Examined the impact of senior leadership and IT infrastructures on companies' assimilation of IT The sophistication of the Information Infrastructure was also found to significantly impact IT assimilation
4	**Diffusion of innovation theory.** Rogers (2010)	Racherla et al. (2013)	Used the diffusion and technology adoption literature to provide individual-level attributes such as skills, attitudes, and norms that drive technology use. Human and technological elements underlying individual access and use are deeply embedded within many institutional features and collectives that enable but also constrain meaningful use.
		Kettinger (1994)	Raises important issues of ownership, management, operation, use, and economics when developing National Information Infrastructure.
		(Cats-Baril et al. 1994)	Study of the successful development of the French national videotex system Teletel. Developing a vision and long-term return on investment are among the factors that contributed to the success diffusion of Teletel.

Table I: Theories Applied to the Study of Information Infrastructure

i. Actor-Network Theory

Actor-Network Theory is one of the main theoretical perspectives to have been adopted to study Information Infrastructure (Ciborra & Hanseth 1998; Fomin 2003; Hanseth et al. 2006; Hanseth & Monteiro 1997; Monteiro & Hanseth 1996). These studies were typically based on some of the early writings of Actor-Network Theorists such as Callon (1986) and Latour (1987). ANT has mainly been used to study the arrangement of social networks or to making an order in a complex world. This arrangement includes human and nonhuman, or technological and non-technological, elements. Through the ANT lenses, studies consider Information Infrastructure evolution as a process in which human actors reflect and inscribe their interest into technology by creating an evolving network of human and nonhuman actors (Aanestad & Jensen 2011; Hanseth & Monteiro 1997; Yoo et al. 2005).

Various Information Infrastructure studies used Actor-Network theory in different ways. Hanseth et al. (2006) used ANT to study the historical factors that influence the creation of ICT standards, and particularly the success and failures factors. The authors used the concept of the logic of ordering, which was adopted from ANT, upon reflexivity and the unexpected side effects adopted from reflexive modernization. They argued socio-technical complexity to be a major issue in IS standardisation and that the critical dynamics related to this complexity related to reflexivity. Reflexivity is the phenomenon by which efforts made to generate certain standards to reduce complexity may produce the opposite outcome (Beck et al., 1994). The authors argued that traditional standardisation methods cannot appropriately deal with such complexity (Beck et al., 1994) and that future research on IS standardisation was critical to help mitigate its increasing complexity.

With their article on inscribing behaviours in information infrastructure standards, Hanseth & Monteiro (1997) sought to explain how the standards and standardisation of Information Infrastructure can be conceptualised as actor-networks and how standards are means to stabilise large actor-networks. The concept of an inscription may help in dealing with the complexity of information infrastructures and develop more suitable standards. Moreover, Ciborra & Hanseth (1998) aimed at investigating what is taken for granted, left out or marginalised in the typical infrastructure management agenda. To that end, a theory like ANT can further expand and evolve the infrastructure agenda. The

authors believed that there are two concepts from actor-network theory that are of particular relevance for enlarging the infrastructure agenda: inscription (the way technical artefacts embody patterns of use) and translation (how user and others interests may be translated into specific needs) (Ciborra & Hanseth 1998). The authors explained that, by inscribing programmes of action into a piece of technology, such technology becomes an 'actant' forcing its inscribed programme of action on its users. Programmes of action should not only be inscribed into inaccessible technological components but rather aligned networks of technologies, human beings, and social institutions. From the translation point of view, stability and social order are constantly negotiated as a social process of aligning interests. As actors have different sets of interests, stability rests significantly on the capability to translate, that is, 're-interpret, re-present or appropriate, others' interests to one's own' (Ciborra & Hanseth 1998).

Also, the relationship between IT and Organization, as one study argued (Monteiro & Hanseth 1996), has to take a stronger grip and take IS quite seriously in order to inform the design and increase social responsibility. To do this, the authors suggested a comprehensive understanding of the characteristics of the relevant class of IS, practically Information Infrastructure and its underlying standards. ANT would consider it best to study IT and Organization in this regard. The authors argue that standard diffusion requires the coordination of the surrounding actors, institutional arrangements, and work practices. (Monteiro & Hanseth 1996).

Fomin (2003) investigated the development of National Information Infrastructure to create a rubric of progress and to promote the diffusion of information technology (IT) revolution. The author argued that to improve the construction of effective policy planning for Information Infrastructure, a conceptual link between the abstract enabling structures and concrete technologies must be established. The study deployed the actor-network method to suggest an analytical technique suited to develop a functional connection model between infrastructures to standards by way of roles through specific social practices and boundary objects, technology and gateways, institutional arrangements and technological fixes (Fomin 2003).

A major criticism of ANT is that it addresses the local and contingent, but pays less attention to the broader social structure which influences the local (Walsham, 1997). Reed (1995) added that ANT involves an analysis that focuses on how things were done rather

than on the ways in which institutionalized structure shape and modify the process of social interaction and the social material practices through which it is accomplished. The other criticism of ANT pertains to its stance on moral and political issues. Winner (1993) added that the theory heavily disregards social constructivism for the social consequences of technical choices.

ii. **Complexity Theory**

Another theory that has been used in studies to explain the Information Infrastructure phenomena is Complexity theory or the complexity model. Such studies were grounded in the literature based on complexity studies of social science (Holland 1995). Complexity theory is a cluster of ways of thinking that developed from those branches of `new science' concerned with the behaviours of natural systems, such as chaos theory, dissipative structure theory, quantum physics, and complex adaptive system theory (Waldrop, 1992). The theory is useful to explain the apparent illogicality of human systems as it `problematizes' things that we may take for granted. Information Infrastructure research highlights how Information Infrastructure evolution is complex, with many actors simultaneously enacting their goals (Henfridsson & Bygstad, 2013). This is where infrastructure evolution is seen as the process by which diverse and autonomous human, or organisational, actors look for the use information technology in adapting to each other and to their external environments (Braa et al., 2007; Ciborra et al., 2000; Hanseth et al., 2006).

A good number of studies used complexity theory to examine various aspects of Information Infrastructure. For example, Braa et al. (2007) used complexity theory to explain the challenges that needed to be highlighted, particularly, the need for standards that can adapt to a changing healthcare environment. The authors proposed the concept of flexible standards as a key element in a sustainable infrastructure development strategy. The concept can be achieved by addressing the complexity of accommodating both global needs of scalability of infrastructure standards and local needs of sensitivity to contextual differences.

Moreover, Hanseth et al. (2006) studied the issue of reflexive standardisation by looking at historical or dependent events, and factors that influence the creation of ICT standards, and in particular, their success or failure. Along with other suggestions, the authors

suggested a theoretical interpretation of standardisation complexity by using ideas from complexity theory and the theory of reflexive modernization.

Complexity theory has been criticised as it needs to be used authentically and not as a loose metaphor, as in some management literature (Stacey, 2007). Although many scholars acknowledged that the theory is conceptually interesting, they argued that it is difficult to apply in practice (Stacey 2007). This makes this theory difficult to apply to cases such as the Government cloud computing implementation project, where there is a clear institutional influence over the implementation of the project.

Moreover, while the literature is full of testimony to the complex relationships that exist between elements that make up an infrastructure (Braa et al., 2007; Ciborra, 2000; Hanseth et al., 2006), there have been few, if any, attempts to formulate perspectives that allow the simultaneous study of multiple causes (Henfridsson & Bygstad, 2013).

iii. Information Infrastructure and Relational model

This model considers Information Infrastructure evolution as a process by which the socio-technical relation that emerges from Information Technology-driven activities is only meaningful for the community-of-practice (Pipek & Wulf 2009; Star & Ruhleder 1996; Vaast & Walsham 2009). Most of this stream of literature in Information Infrastructure is brought from the theory of learning and work practice (Engeström, 2014; Lave & Wenger, 1991). Moreover, the relational model explains how Information Infrastructure should be valued from the sensemaking of its stakeholders and users (Henfridsson & Bygstad, 2013).

Various studies have adopted this concept. For example, Vaast & Walsham (2009) investigated the practice-based learning dynamics that occur among groups who share work-related practices but do not necessarily work with each other or even know each other because of geographical or organisational distance. They proposed a model of what the authors call trans-situated learning that is supported by the local universality of an information infrastructure, the use of which becomes embedded with other infrastructures.

Another study examined the impact of senior leadership and IT infrastructures on the companies' assimilation of IT into their value-chain activities and business strategies (Armstrong & Sambamurthy, 1999). The concept of Information Infrastructure

capabilities can be developed by identifying Information Infrastructure services (Broadbent et al., 1999; Henningsson & Henriksen, 2011; Renkema, 1998) and how the technical, behavioural and business capabilities of IT personnel are associated with Information Infrastructure capabilities (Neumann & Fink, 2007). Alone within other non-Information Infrastructure findings, the study highlighted how the sophistication of Information Infrastructure was also found to significantly impact IT assimilation.

It is important to study Information Infrastructure from the relational perspective. However, using this model without consideration of institutional influence would not provide the full picture of how global institutions influence local users.

iv. Diffusion of Innovation Theory

Another interesting theory used in the study of Information Infrastructure is the diffusion of innovation theory (DOI). Rogers (2010) introduced the basics of innovation theory, which defined innovation as an idea, practice, or object new to the organization adopting it. Moreover, the diffusion of innovation refers to the continuing spread of innovation in organisations. It reflects the communications that lead to adoption and implementation choices. This does not mean that whatever is being implemented by an organization is new; in fact, many innovations involve more imitation than invention (Rogers 2010).

Diffusion of innovation theory has been adopted in many studies to explain the adoption, implementation, and use of information technologies by individuals, organisations, and industries (Cooper & Zmud, 1990; Jaakkola et al., 1991; Prescott & Conger, 1995). Diffusion of Innovation theory has gained wide popularity in the IT field (Prescott & Conger, 1995) as slow and painful Adoption Information Technology has to lead the scholars and practitioners to seek to understand and manage its diffusion.

Racherla & Mandviwalla (2013) studied Universal Access vs Universal Use in Philadelphia. The goal of the project was to provide ubiquitous connectivity to enable access and use of the Information Infrastructure and to foster innovation and growth. The results show that the human and technological elements underlying individual access and use are deeply embedded within many institutional features and collectives that enable but also constrain meaningful use. The contribution of this paper is in providing a bridge between the analytical orientation of the innovation systems literature (i.e., in identifying

key functions and structures) and the outcomes and variance approach that is typically taken in IS research (Racherla & Mandviwalla, 2013).

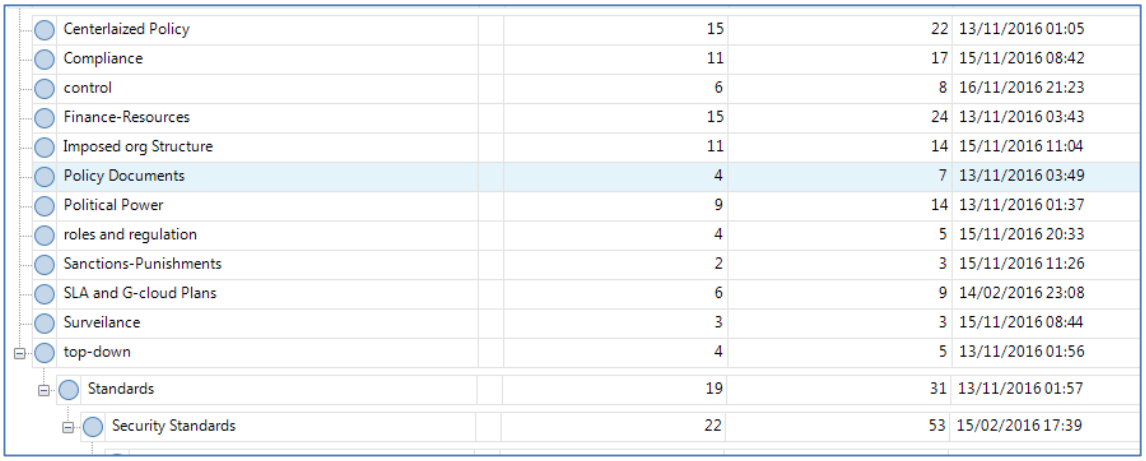
Kettinger (1994) used DOI theory to study one example in the United States' effort to build an 'Information Super Highway'; which may determine the way its citizens create and communicate knowledge in the next century. The author used the McFarlan & McKenney diffusion process model to help describe four phases of NII development. These phases are Technology identification and initial investment, Technological learning and adaptation, Rationalization and control, and Maturity/widespread technology transfer. For each phase, the study looks at how a national information infrastructure is developed, how it is funded, who has access, what applications are offered, and how it is managed. The study raises important issues of ownership, management, operation, use, and economics when developing a National Information Infrastructure.

Moreover, Cats-Baril & Jelassi (1994) used DOI theory to study the development of the French national videotex system Teletel. The technical and political factors that made Teletel successful are explained and contrasted with other national videotex systems that became commercial failures. Political intrigue, technical capability, creative choices, and the deep pockets of a government-owned utility are all part of the successful Teletel story. The study found that developing a vision, building and maintaining a state-of-the-art network, taking a long-term perspective on return on investment, and giving public gateways to the network free of charge were among the factors that contributed to the successful diffusion of Teletel.

Lyytinen & Damsgaard (2001) argued that DOI misses some important aspects of complex and large technology. The authors suggested that researchers should recognize the complexity, network, and learn an interactive feature of technology and understand the role of institutional regimes. Moreover, they should also recognise when it is important to investigate the implementation stage of Information Infrastructure where there are other issues and challenges that it is important to highlight and explore. When it comes to the Implementation of Information Infrastructure, other theories can be a better fit.

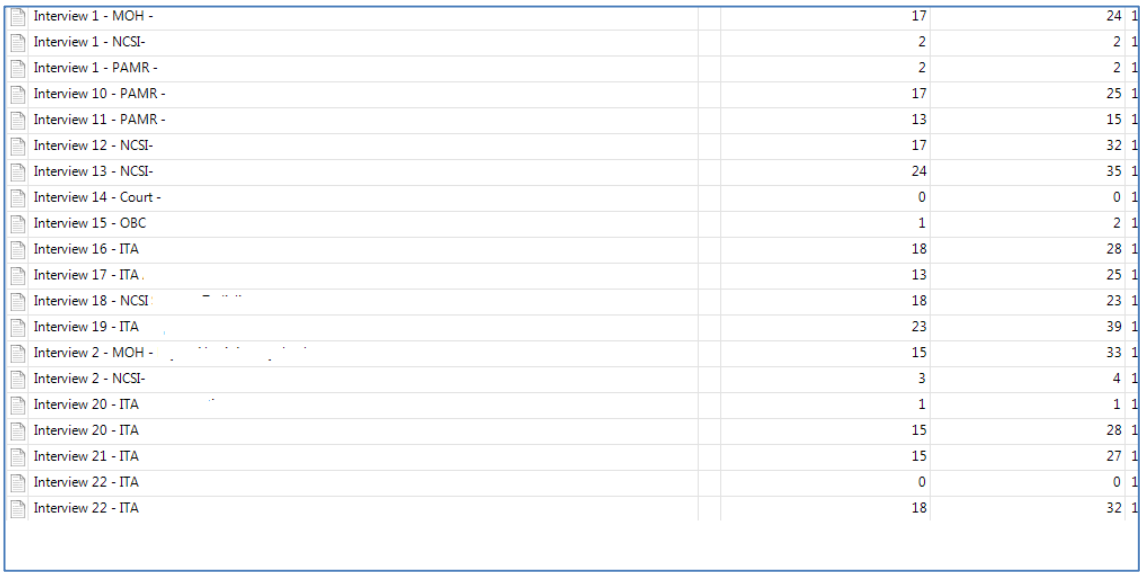
Appendix E: Examples of Nvivo contents

i. Nvivo Sample 1



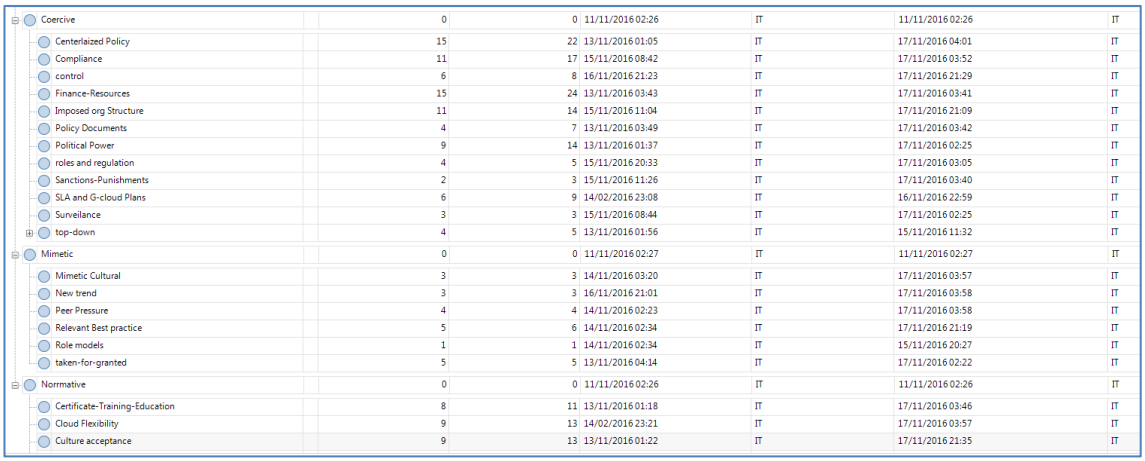
Centerlaized Policy	15	22	13/11/2016 01:05
Compliance	11	17	15/11/2016 08:42
control	6	8	16/11/2016 21:23
Finance-Resources	15	24	13/11/2016 03:43
Imposed org Structure	11	14	15/11/2016 11:04
Policy Documents	4	7	13/11/2016 03:49
Political Power	9	14	13/11/2016 01:37
roles and regulation	4	5	15/11/2016 20:33
Sanctions-Punishments	2	3	15/11/2016 11:26
SLA and G-cloud Plans	6	9	14/02/2016 23:08
Surveilance	3	3	15/11/2016 08:44
top-down	4	5	13/11/2016 01:56
Standards	19	31	13/11/2016 01:57
Security Standards	22	53	15/02/2016 17:39

ii. Nvivo Sample 2



Interview 1 - MOH -	17	24	1
Interview 1 - NCSI-	2	2	1
Interview 1 - PAMR -	2	2	1
Interview 10 - PAMR -	17	25	1
Interview 11 - PAMR -	13	15	1
Interview 12 - NCSI-	17	32	1
Interview 13 - NCSI-	24	35	1
Interview 14 - Court -	0	0	1
Interview 15 - OBC	1	2	1
Interview 16 - ITA	18	28	1
Interview 17 - ITA	13	25	1
Interview 18 - NCSI	18	23	1
Interview 19 - ITA	23	39	1
Interview 2 - MOH -	15	33	1
Interview 2 - NCSI-	3	4	1
Interview 20 - ITA	1	1	1
Interview 20 - ITA	15	28	1
Interview 21 - ITA	15	27	1
Interview 22 - ITA	0	0	1
Interview 22 - ITA	18	32	1

iii. Nvivo Sample 3



Coercive	0	0	11/11/2016 02:26	IT	11/11/2016 02:26	IT
Centerlaized Policy	15	22	13/11/2016 01:05	IT	17/11/2016 04:01	IT
Compliance	11	17	15/11/2016 08:42	IT	17/11/2016 03:52	IT
control	6	8	16/11/2016 21:23	IT	17/11/2016 21:29	IT
Finance-Resources	15	24	13/11/2016 03:43	IT	17/11/2016 03:41	IT
Imposed org Structure	11	14	15/11/2016 11:04	IT	17/11/2016 21:09	IT
Policy Documents	4	7	13/11/2016 03:49	IT	17/11/2016 03:42	IT
Political Power	9	14	13/11/2016 01:37	IT	17/11/2016 02:25	IT
roles and regulation	4	5	15/11/2016 20:33	IT	17/11/2016 03:05	IT
Sanctions-Punishments	2	3	15/11/2016 11:26	IT	17/11/2016 03:40	IT
SLA and G-cloud Plans	6	9	14/02/2016 23:08	IT	16/11/2016 22:59	IT
Surveilance	3	3	15/11/2016 08:44	IT	17/11/2016 02:25	IT
top-down	4	5	13/11/2016 01:56	IT	15/11/2016 11:32	IT
Mimetic	0	0	11/11/2016 02:27	IT	11/11/2016 02:27	IT
Mimetic Cultural	3	3	14/11/2016 03:20	IT	17/11/2016 03:57	IT
New trend	3	3	16/11/2016 21:01	IT	17/11/2016 03:58	IT
Peer Pressure	4	4	14/11/2016 02:23	IT	17/11/2016 03:58	IT
Relevant Best practice	5	6	14/11/2016 02:34	IT	17/11/2016 21:19	IT
Role models	1	1	14/11/2016 02:34	IT	15/11/2016 20:27	IT
taken-for-granted	5	5	13/11/2016 04:14	IT	17/11/2016 02:22	IT
Normative	0	0	11/11/2016 02:26	IT	11/11/2016 02:26	IT
Certificate-Training-Education	8	11	13/11/2016 01:18	IT	17/11/2016 03:46	IT
Cloud Flexibility	9	13	14/02/2016 23:21	IT	17/11/2016 03:57	IT
Culture acceptance	9	13	13/11/2016 01:22	IT	17/11/2016 21:35	IT

iv. Nvivo Sample 4

<Internals\\Interview 1 - MOH - [redacted]> - § 1 reference coded [3.69% Coverage]

Reference 1 - 3.69% Coverage

I think the way of communication is important, for example, take a look at e-government, all organization thought ITA will do their job on achieving the e-government, and the ministries slept on that, until they felt nothing is moving, so the ITA now have thrown the ball on them again. I believe the ITA is right, as they are supposed to be the policy maker and regulator. But did the message are delivered to the ministries, was there enough awareness. I think there were miscommunication between them. Now after the mandate from the prime mister office, every one became more aware of their roles and obligations. Also, the same case with G-Cloud. They need to do a lot marking to tell the ministries about the benefit of Oman g-cloud. If I ask you how many portal are, and how many of them are in g-cloud.

<Internals\\Interview 12 - NCSI- [redacted]> - § 2 references coded [4.75% Coverage]

Reference 1 - 1.24% Coverage

Also, the driving force that you cannot host here, is the regulation of the country, for example you cannot allow someone to work 24/7 as you cannot provide an overtime for them, so there are some limitations there which also make you not host here.

v. First Cycle Coding Table

The table below provides a sample of first cycle coding which shows how the data were collected and how it was informed by the theory.

	Codes	Groups Codes
1	PKI Access, Control, Cloud Computing Security standards, Cybersecurity Maturity Capability model, hack or attack issue, security measures, Maybe security is affecting the performance,	Security
2	More about the connectivity, has it to be high-speed broadband access, enhance the speed, ITA through fibre line, connectivity with the remote site, Oman broadband company, internet leased line, build their passive infrastructure,	Broadband Issues
3	Trend. Big Data, Datacentre, Cost, security, performance, Service enablement, data retention, SLA, Integration, sharing data, Expandability, saving implementation time.	G-Cloud Advantage
4	involving the end users, convey the concept of the cloud to people, Conferences and awareness, communications issue,	Management Interaction
5	no training, training only for G-Cloud employees, special training for every	Training

	team, Technical training, administrative training, technical training, simple training, deep training, short training(3 to 4 hours), training is not enough, infrastructure training, G-cloud training, security training, new technology training.	
6	Government employee awareness, Public awareness about the G-Cloud, ICT employee awareness about the G-Cloud	Awareness
7	Qualified people, Previous experience about the G-Cloud (Employee, organisation), No experience on G-Cloud, Virtual Machine experience, G-Cloud architecture experiences, learning experience.	Experience
8	ITA funds, tender control, G-Cloud Financial support, ITA G-Cloud project, Government Agencies cost saving, reducing overhead, CAPEX, OPEX, less Bill of Quantity, government money, Cost to be hosted in the G-Cloud is free, cost reduction	Financial control/support
8	ITA is the main sponsor of IT strategies, CEO is a board member of some government agencies, Management relationships,	Management control

9	Decision made by top managers, control comes from ITA, ITA security, PKI from ITA	Top-down
10	ITA is a policymaker, Ministerial Council mandates on G-Cloud, Country regulation to host inside Oman, local work regulations (difficult for government agencies to work 24/7).	Roles and regulations

vi. Second Cycle Coding Table

The Table below provides a sample of Second cycle coding which shows how the data were collected and how it was informed by the theory.

#	Codes	Groups of Codes
1	Centralized Policy, Political power. Rules and regulations, Client Requirements, Sanctions/Punishments, Top-Down, Finance/resources, Policy Documents, Surveillance, Compliance, Imposed org. Structure	Coercive
2	Culture acceptance, Professionalism, Experience, Installed Base Cultivation, Certificate, training, Education, Management, Intervention/pressure, Routines, Unions	Normative
3	Mimetic Cultural, Taken-for-granted, Relevant Best practice, Role models,	Mimetic

	Mental Model of Competition, Uncertainty. Peers, Successful organization/country	

Appendix F: Details of expert Panel members

*Table:*Details of the expert panel members*

Seq.	Panel Member	Position	Affiliation/Filed of work	Area of Expertise
1.	Dr. Shahid Al Balushi	Assistant Professor of supply chain and expert in international cooperation office	Sultan Qaboos University in Oman	Institutional Theory and Social Capital Theory
2.	Dr. Qasim Al-Mamari	Assistant Professor of Information Technology and Systems	Colleges of Applied Sciences	Institutional Theory and qualitative research methodologies
3.	Mohammed Al-Farsi	Member of the Board of Trustees at	Muscat University	Institutional Logics and qualitative research.